

JULY

(Quarterly Volume)

VOL. LXXIV.]

1891.

[No. 161.]

JOURNAL

OF THE

Royal

United Service Institution,

WHITEHALL YARD.

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL.

EDITOR OF THE JOURNAL: THE SECRETARY

OF THE UNION OFFICE: COL. LONSDALE HAILE, F.R.S.

Printed and Published by the Secretary of the Union Office, Whitehall Yard.

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ERRATUM.

On page 630 of No. 160 of the Journal, line 29 from the top, *for* "nor do I care so much for the *four-gun ships*," read "nor do I care so much for the *two-gun ships*."



The Journal
OF THE
Royal United Service Institution.

VOL. XXXV.

JULY, 1891.

No. 161.

[Monthly Issue.]

Friday, May 15, 1891.

LIEUT.-GENERAL SIR MARTIN DILLON, K.C.B., C.I.E., in the
Chair.

MILITARY SMALL ARMS.

By LIEUTENANT-COLONEL G. V. FOSBERY, V.C.

IN the 'month of May, nine years ago, I stood up in this theatre to lecture on magazine guns: a subject at that time new to many of my hearers. I then proposed to lay before this Institution, and through the Institution before the Services and the country at large, the reasons which in my opinion rendered advisable a change in the armament of the soldier. I discussed the merits of the various weapons then existing, to claim adoption at our hands. I strongly advocated the abandonment of the single loader for the magazine arm or repeater, and expressed a hope that what I had to say might, in ever so small a degree, contribute to the revolution which I desired to see accomplished. In the following year I again spoke on this subject, and was able to show something of the progress that invention had made in the meantime, not forgetting to point out how some of the more ancient weapons had already been excelled or superseded, and to draw attention to newer devices.

Amongst these were the Spencer repeating rifle, Pieper's electric gun, and a sheet-metal cartridge holder or clip, which I myself had devised for loading the cartridges *en bloc* into the magazines—which, new at that time, has since been very largely developed and adopted.

The controversies of those days have now been settled. The cause I then so strongly advocated has been won, and five millions of men are now armed or arming for the battles of the world with the guns to which I then drew your attention; and so closely have some of my indications been followed, that I think I may not unreasonably claim

to have directed the attention of those responsible for the change to several of the points needing consideration in effecting it.

Side by side with the change of weapons, a no less important one has been made in the ammunition they carry.

That such should have been the case is but the logical consequence of the adoption of the repeater.

From the moment this was decided on, it was seen that, in the first place, it would be desirable to reduce the size of the cartridge so as to maintain the handiness of the weapon; and, secondly, to reduce its weight in order that the soldier might carry a larger number—wrongly or rightly supposed to have become an absolute necessity.

To reduce the *size* of the cartridge, the space occupied by the charge must be diminished, and for this either the present charge must be made to occupy a smaller space, or a more energetic explosive be found.

We are thus at once compelled to use either compressed gunpowder or one of the higher explosives.

Again, to take largely from the weight, the bullet must be lightened; and here we must be careful. The range of artillery is increasing every day and the bringing of quick-firing guns into the field is but a question of time. The infantry cannot afford to lose a yard of their range. The sectional density of the bullet cannot, therefore, be lowered—nay, rather needs increasing—and the reduction in weight must be effected by a diminution of calibre.

Many of us were in hope that this would go no further than to 0.400 inch or 0.380 inch, when a plain hardened bullet could have been used, and a very considerable economy in the price of ammunition been effected.

When, however, it came to be seen what velocities, range, and penetration could be got with a thing like this, no bigger than a common pencil-case, the calibre of 0.303 was decided on, and with it, as a consequence, the metal envelope, regarding the cost and other difficulties of which so much has been said.

The studies of Hebel, Guillaumot, and the practical experiments of Lorentz prepared the way for this or even a greater reduction of calibre; so that, in theory, no risks of mistake were run.

It may be an open question whether or no at extreme ranges the fire of the new magazine gun will be as fatal as is that of the Martini-Henry, and whether it would be possible with it to inflict on a distant enemy such terrible losses as fell upon the Russian columns in the valleys near Plevna from Turkish unaimed high-angle fire. We all know that a very small and light bullet, having a speed of 1,600 feet per second or over, *i.e.*, a bullet travelling at so-called *express* speed, will smash bones and tear up and pulverize flesh in a way totally different from the behaviour of the same bullet endowed with a lower velocity, and it may prove to be the case that, beyond certain ranges, the effects of the new projectile, say on supports and reserves, will be less than those of the heavy Martini bullet in a very notable degree.

As, however, we are promised an initial velocity of something

approaching 2,000 feet per second, no doubt we shall have an extremely flat trajectory and deadly effects for a very considerable distance, and, in any case, what is true of our own bullet will—so nearly alike are they—be true of every other bullet in Europe.

At present, so far as is known to me, we are still in search of the ideal explosive: one, in fact, which shall pack into the smallest possible space, develop the utmost energy, and keep indefinitely under all possible circumstances; and until we have found this, or at all events some reasonable approach to it, we cannot with a light heart adopt, as our Continental friends have done, a smokeless powder for the use of our troops. Gunpowder we know all about; it is a good honest mixture, and, sorely tried as it frequently is ashore and afloat, it may be always reckoned on to do its duty so long as we keep it dry. But when we come to high explosives—specially when these are chemical compounds and from their very nature more or less unstable compounds at that—we, more than any other people, must exercise the utmost precaution in their general adoption, and be sure that neither the damps and heats of India, the salt air in our naval magazines, nor the cold of Canadian winters, will set these treacherous substances fermenting, decomposing, or exploding.

Hitherto perhaps on the whole Professor Abel's powder, cordite, has shown the best all round qualities, and bids fair for final selection.

Having thus spoken of the ammunition question, which will, I believe, when fully settled, effect a more marked change in the conditions of war than even the adoption of the magazine gun, I will, if you please, return to the question of the latter.

It will be, I think, a useful introduction to the study of the weapons themselves if we look for a moment at the general principles which have governed their construction. As you see here without a single exception, the infantry weapons of to-day are bolt guns. We ourselves, after more than thirty years of experience with the Snider and Martini—those good, solid, eminently safe, and more than all safe-looking guns—have come to use a bolt, the forward end of which takes the whole face of the discharge, and the hinder end of which points directly into the soldier's eye at the moment of firing; and more than that, we fire it ourselves, and give it to our men with perfect confidence. The loss of faith in their weapons which would follow any serious accident would be so disastrous to the *morale* of the Army, that even were we not as we are, to a degree solicitous about the lives and limbs of our men, sound policy dictates an extraordinary care in the selection of their firearms. This is so well understood abroad as well as here, that you will notice in all these weapons a massiveness and weight of metal far beyond the proportions that would be required to stand the charges they are expected to fire, or than is rendered necessary solely by the rough usage to which they may by-and-by be exposed. We, more than others, so far as our system will allow of it, take particular pains to make our guns as light as possible consistent with that strength, and incur great expense in doing so.

Did we know as much about the marching of our soldiers as we do about the running of our horses, I could no doubt inform you what difference it would make in the time of a 10-mile march were the men's guns lightened by an ounce apiece.

But the advantage we gain can be put in another and very intelligible shape. If we take a pound off each man's rifle and give him a pound more ammunition to carry, 5,000 men will carry over two tons more of weight of cartridges on their bodies. And two tons of ammunition judiciously thrown in are capable of doing a vast amount of useful service: besides which, as ammunition is more easily carried than an equal weight of gun, for the reason that it can be more easily distributed, the soldier is still the gainer.

The bolt principle on which these weapons are constructed has no doubt several grave disadvantages. Some of them have been minimized in the later guns, but some still remain in full force. To carry the bolt and ensure its correct movement, a long action or shoe is required; and when, as in most of these guns, the abutment which supports the bolt against the force of the discharge is at the rear end of the shoe, the walls require to be of considerable strength and weight to secure absolute safety, as does also the bolt itself.

We are compelled to use a shorter barrel, or if not, the shoe and bolt at all events occupy a disproportionate length in the gun, and weigh more than is necessary. In any case, compare these cumbersome contrivances, which are more or less inseparable from the system, with the small neat wedges of the Sharpe, Field, or Deely-Edge rifles.

There is, however, a form of bolt gun where this shoe can be modified in many ways, nay, almost entirely done away with, and the safety of the locking device still be maintained. I mean when, as in the German, the Mauser, and the Godsäl guns, the locking device consists in wings or projections on the head of the bolt, which lock (something on the cut-screw principle) into recesses formed for them, either in the barrel itself or in the forward end of the shoe. We thus have a mechanical equivalent of the wedge, but brought into operation by a circular instead of a vertical motion. The rest of the bolt then becomes merely a means of rotating its forward end, and a convenient carrier for the mainspring, extractor and firing-pins.

Major Godsäl has been the first to see the full importance of this peculiarity, and has substituted for the shoe a simple rail on which slide to and fro the block, the lock, and the extractor.

In the early days of repeaters, two methods of converting the bolt gun for the purpose occurred to the inventors of that day. They either adopted the Winchester tubular magazine under the barrel, and concealed it in the wood of the fore-end, *e.g.*, the Kropatchek and Mauser; or they placed a similar tube in the stock, as for example, the Hotchkiss, Shulhof, and Deely-Edge. It was reserved for Lee to devise the position for the magazine, and method of feeding up the cartridges, recognized to-day as the one which for military purposes will supersede all others; placed symmetrically and close to the centre of gravity of the arm, the magazine, when full, causes

neither breech nor muzzle preponderance (to borrow a phrase from our friends of the artillery), and the act of emptying it lightens the gun without disturbing its balance.

In the Kropatchek and similar weapons, as the magazine was emptied, the muzzle tended to rise; and when firing at an advancing enemy, increased the elevation the nearer he came, and though the others had the opposite tendency, the leverage on the gun was so much less that it produced no positive advantage.

Moreover, notwithstanding the professions of inventors that these tubes formed a practically safe method of carrying loaded cartridges, when the bullet of one was continually in contact with the cap of the next, no one absolutely believed there did not exist a risk which it would be a relief to get rid of; and when Lee showed them the way to do this, they one and all seized on his idea, with or without his permission, and the results are here in this rack before you: the Mannlicher, the Mauser, the German, and Italian, all alike owing their success and adoption to the principle he discovered for them, and to his years of laborious, and often hopeless, struggle.

Our own weapon, as of course you know, is the Lee, rifled upon Metford's system, which includes not only the form and pitch of grooves but the method of cutting them, and having certain minor improvements, which the experience gained in the trials to which it was subjected has suggested, besides being fitted with a divided stock, which has improved and strengthened the gun.

The remainder are bolt guns of various types, some of them having interesting and novel details of construction, but all of them alike indebted to Lee for the position and operation of their magazines.

The next point is the method by which the magazines are filled.

In the old times of tubular magazines, the cartridges were inserted one by one through a trap, and against the pressure of a spring, except in the case of Shulhof, whose gun, unacceptable for other reasons, was yet admirable for the way in which the difficulties of cartridge supply were got over, and for his method of loading from boxes.

The early Spencer musket, too, which was used with such signal success in some of the actions of the American War of Secession, had a notable device for getting over this difficulty. The tube in the stock had a steel lining, which contained a spiral spring, and was fixed in place by a bayonet catch, in the butt. To load, this tube was withdrawn, spring and all. The cartridges were then dropped into the hole, and the tube returned. This slipped down outside the cartridge, the spring being at the same time set in compression, and seven rounds were thus inserted very easily and quickly.

Now, however, that the central magazine has been universally adopted, the problem has become a far easier one, and the cartridge carrier or clip has come into use in every case but our own. This in its turn has effected a singular change in the ideas prevalent as to the true uses of the magazine gun; for those who have adopted the clip have at the same time entirely abandoned single loading for ordinary occasions. The soldier is taught to fire exclusively from

the magazine; one clip when emptied is replaced by another, and as these clips do not contain more than five rounds each, there is not in the gun, even at the best of times, a sufficient reserve of ammunition to meet a rush; while the soldier can never be certain exactly how many charges he has to dispose of before he must reload. Moreover, he must exhaust the clip he has, before he can replace it with a full one.

Thus the clip system for ordinary occasions accelerates the fire of the weapon, inasmuch as five cartridges can be put in nearly as quickly as can one in single loading, the other operations being the same in both cases; but to get off ten rounds, the soldier will almost certainly have to put in two clips besides the one already in place, and, as will easily be seen, the whole process is a slower and less effective one than the withdrawal of the "cut-off," and the emptying of the magazine at the moment of special need.

Now though this system runs counter to the original conception of special reserves of ammunition for special occasions, there are not wanting those who hold that the five cartridge clip system is a better one than our own. Their main argument is this, that the soldier should not be taught in cases of emergency to do anything which he is not in the habit of doing on every other occasion; if he is, confusion and disaster are likely to accrue. But let me ask you who, in your opinion, is likely to keep the cooler head, and meet a sudden attack with that steadiness of mind as well as hand, which alone carries the man triumphantly through sudden and imminent peril—the man who, having one round in his gun, knows he will have to fumble in his pouch for the next; the man who, some time since, put five cartridges into his gun and knows not how many he has left, and when he shall have to reload; or he who, by simply touching a slide, puts at his own disposal enough ammunition to see him through any crisis without having to think of reloading at all? I think there can be no doubt of the answer. We must not forget, however, that while we hold in this particular undoubted supremacy, the everyday fire of the clip guns must exceed our own in rapidity.

If a method of loading our magazines *en bloc* could be devised, I am of opinion that a great advantage would be secured; some ingenious gentleman has, I believe, imagined that the difficulty can be got over by using two clips at once, actuated by a couple of spring arms placed side by side, but this no more gives us a reserve for an emergency than does the single clip system; and the uncertainty of what the gun may at any given moment contain remains as great as before.

Briefly. The controversy lies between "cut-off" and "no cut-off," and not, as might at first appear, between two different methods of filling the magazines; the "cut-off" in our case being a simple steel plate, and adding no complication to the gun worth a moment's attention.

We have, to sum up, now arrived at this point, viz., that the military small arms of to-day are bolt guns on various plans, but one and all having magazines of the Lee type (see Plate); that there are two

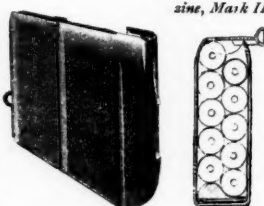


PLATE SHOWING THE BOLTS AND MAGAZINES OF 3 TYPICAL SYSTEMS.

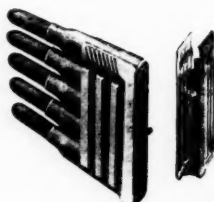
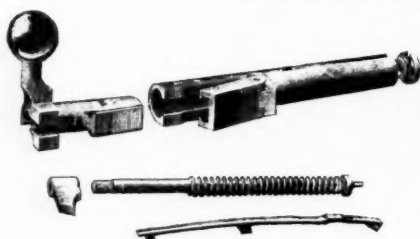
"LEE," ENGLISH.



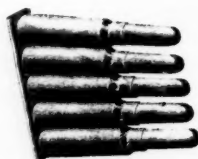
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"MANNLICHER," AUSTRIA.



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methods of filling these magazines, the domestic way with the fingers and the foreign way with clips; but above all, that there are also two ways of using these magazines, the one as an accelerator of the ordinary rate of fire of the weapon, the other as a valuable reserve for moments of more than ordinary exigency or peril.

We have also been able to form some idea of the arguments which may be used for and against each of these methods, and I will now, if you please, commence an examination of the guns themselves, beginning with the German.

This gun, besides its magazine, has many interesting features which well merit our careful attention, more than one of them being entirely new departures.

As you see it, the first thing that will probably strike you is the great size of the barrel, and secondly the small size of the magazine as compared with our own and other patterns.

The true barrel, however, is not seen at all, except just at the muzzle. What we have here is an outside casing of thin steel, strong enough to take all the knocks it may get, to protect the shooting barrel from injury and to carry the bayonet and sights; the air space between the two prevents it from becoming so over-heated as to burn the hands or melt off the sights in rapid firing.

The true barrel is secured to this casing at the breech end, but at the muzzle passes freely through the tube which terminates it at that point; it can thus expand or contract freely, a very great advantage. We all know how often the shooting of a rifle was spoiled by tightening up one of the screw bands unduly, and how when the wood to which the barrel was secured shrunk with heat or swelled with moisture, it was liable to go a bit off its shooting on its own account.

Here, of course, nothing of the sort can occur.

Some ingenious plagiarist has lately done this simple arrangement the honour of improving upon it; he fills the air space with some absorbent substance, provides a water tube to wet the same, and makes a hole near the muzzle for the escape of steam.

I think we can some of us guess in what condition such weapons would be found a few months after issue.

We next come to the magazine, which is, and looks, extraordinarily small; there is, however, room in it for the five cartridges it is intended to contain, and the clip which carries them. There is but little to note in the magazine beyond the simple form of the spring and the platform attached to it to bring up the cartridges; the platform, when the magazine is empty, converting the gun into a single loader. It cannot, however, be used as such as long as any cartridges remain in the magazine.

Lest, however, it should be necessary at any time to fill it while two or three cartridges may still be left, provision is made for ejecting the clip and whatever is in it, by touching a spring which releases it and it is then thrown out of the gun by the cartridge elevator. A full clip can now be inserted; this is a device, however, which is necessarily wasteful, and would probably be seldom resorted to.

However, here is the clip system at its very best, and an inspection of this gun will enable you to compare it with our own. There are, besides the outer barrel and magazine, one or two valuable points about the action. In the Lee, and several other bolts, the spring is set to full cock by means of a catch or bent attached to the firing pin, which is held back by the trigger or sear when the bolt is sent home; and when the latter is locked is retained in tension until released by the action of the trigger.

In this gun, however, as in the old Chassepôt and others, the body of the bolt carries an inclined plane or cam which abuts against a piece attached to the firing pin at its rear end; when the bolt is rotated to open the gun, this cam sets back the firing pin and retains the spring in compression until the bolt is returned to its place, when the act of locking it releases the firing pin, which is, however, now held in place by the sear until the gun is fired as before.

This arrangement has the distinct advantage of relieving the soldier's hand from the jarring action caused by having to send the bolt home against a powerful spring with the palm of the hand or muscles about the base of the thumb, an action which in rapid and prolonged firing has been found to cause serious damage to the soldier's hands from the mass of nerves which are involved and which get bruised and injured.

Again, the recoil being supported by these wings, which take into recesses in the action close behind the chamber of the gun, the rest of the bolt becomes, as I have said elsewhere, merely a means for operating the locking device, and carrying the extractor, the mainspring and firing pin; and the inventor takes advantage of this circumstance to make the shell of the bolt thinner than could otherwise be done, which gives him a larger and more powerful mainspring.

Mausser has gone still further in this direction; but in the opinion of those competent to judge, he has left so little metal, especially at the part where the handle joins the bolt, that a heavy blow (as in some bolt guns is sometimes necessary to release the cartridge), or any rough usage would be apt to deform the tube at that point or detach the handle altogether.

But the Germans seem to me to have got their advantage without weakening the gun, and those who know how difficult it is to make long wire springs of very small diameter work freely and pleasantly, will appreciate the advantage they have secured.

Yet another device is the neat little starter on the left side of the head which, lying under the head of the cartridge as it is withdrawn, brings up against a stop in the shoe at the end of the stroke, and throws it out of the grip of the extractor and clear of the gun.

It is very neat, but I recollect seeing its exact equivalent in a carbine by Bethel Burton which I once showed in this place, and which at that time (eight years ago) was already a weapon of very mature age. Most of these little things have been invented and re-invented so often that no one knows exactly or could discover if he wished it where they come from, and I have heard in explanation of

what would otherwise in some instances look like, to say the least of it, a misappropriation of ideas, that the inventors personally are all honest to a man, but that so much thought has been, and is being devoted to this subject, that unconscious cerebration takes place among them, and they involuntarily, or even against their will, take each others' notions; details of bolt guns and fire arms generally being in the air and infectious like the influenza. On this point, however, I am not, I will confess, psychologist enough to pronounce with certainty. But I must say, judging by results, it does not seem unlikely.

I now turn to the Mannlicher, of which the bolt and action alone with magazine attached, will illustrate better than could be done in any other way what I said a little while back about the length and weight necessary to every type of bolt, other than those which, like the one just described, take these bearings close up to the head. See what a mass of iron and steel we have here! The magazine is in principle the same as the one we have just examined, but the bolt itself is, I will not say an entirely new departure, but differs widely from bolt guns in general, inasmuch as the usual method of locking it by a quarter turn is not resorted to; the bolt draws straight out and is pushed straight home again.

It was a serious accident with a gun of this very sort, if I remember rightly, that intensified, in the early days of breech-loaders, the English dislike of bolt guns, and for so many years deferred their introduction into this country; though probably the principles of the two weapons have little else in common. Here the security against accident is ample; the head of the firing pin is protected against an accidental blow when loading, the rise and fall of the hinged abutment-piece is mechanically certain, and until it is down in its place and entirely secure there, the firing pin cannot reach the cap with force to explode it.

The inventor, however, for the sake of securing a motion different from those of his competitors, has sacrificed one of the most valuable features of the bolt system. I mean the powerful cam action by which, in all other guns, the cartridge is started for a short distance in the chamber before being finally withdrawn by the bolt. This action is so powerful that it scarcely makes itself felt by the firer, except in the case of a very bad stick indeed; but if you will put a tight cartridge into the chamber of a gun not having the action you will, I think, be astonished at the force which will now be required to withdraw it by the mere pull of the bolt, and will understand stories you have heard, of men in action, unable to get these guns open from the sticking of the cartridge, being forced to place the butts of their muskets on the ground, and stamp on the handles; and even were this not the case, what does Mr. Mannlicher gain by this pattern of gun beyond a claim to originality? The motion of the bolt cannot be made in less time, nor can the magazine be emptied without taking the gun down from the shoulder any better than can be done with other bolt guns, that is to say, it cannot be done at all.

The guns adopted in Germany, Austria, and Belgium are of good

Continental type, and though they would hardly come up to our own requirements, will, no doubt, do admirable service in the hands of those who carry them. They have one fault in common with the French, and almost every other type of bolt gun, an immensely long pull off, so that when pulling the trigger it is almost impossible to say at what precise instant the gun will go off, and the action I hold in my hand has besides a sort of double motion from the plan on which the trigger is constructed. The first pull brings a fulcrum to its bearings, then leverage is exerted and the catch which holds the firing pin is gradually withdrawn, and by-and-by the cartridge explodes. We, ourselves, should not be satisfied with this, and I must say that the pull off of our own gun is all that can be desired.

I should like to have shown you to-day the Mauser gun to which I have before alluded, the weapon now carried by the Turks and Belgians in Europe, and the Argentines over the water. I had one placed at my disposal for the purpose, but it was unfortunately abroad, and there has not been sufficient time to get it home. What I have said as to the placing of the locking projections on the front instead of the rear of the German and Mannlicher bolts applies also to the Mauser, and his bolt, as I think I said before, is turned out to a greater extent than the Mannlicher. He secures a mainspring of larger diameter it is true, but he only does so by a loss of strength in his bolt which I should be the last to approve. Of course, with the best of materials, the most perfect workmanship, and fair usage, such a bolt will answer every purpose and last for ever, but the soldier's gun should have a larger *margin of safety*, as it is called, than almost any other bit of mechanism known.

Neither teaching nor experience will persuade some folks that a soldier's rifle may not with advantage serve as a pike or even a spade handle, while half the world believes that at close quarters it is used as a club as a matter of course. Those who best know the truth of the matter are aware that in camp and in the field, and even still more at sea, guns get an amount of knocking about which it is a wonder they stand at all, and which severely taxes the very best of them.

One very important feature of the Mauser as compared with the Mannlicher I have forgotten to mention: it is this. Whereas the Mannlicher carries its cartridges in a clip which, with the cartridges, is forced into the magazine and drops out through the bottom of the magazine when empty, the Mauser also has a clip, but of extremely simple form, consisting indeed of nothing but a strip of thin steel, turned over at the two edges, into which the cartridge heads slide and where they are retained by a bit of ribbon steel acting as a spring. This clip is placed over the mouth of the magazine, which is in the Lee position, and the cartridges are forced out of it and into the magazine with the thumb. Once there, they are retained in place by the overhanging sides of the magazine itself, which, being made of sheet metal, has its sides so cut into as to form a couple of springs, which are strong enough to hold the ammunition against rising vertically by the force of the feed spring underneath it, but not strong

enough to prevent the cartridges from being forced out of it longitudinally one by one by the action of the bolt.

This being so, it is easy to keep the magazine full by adding a fresh cartridge by hand when one has been fired, and thus always maintain a reserve of four; this gun, therefore, used in this way, has the properties of our own in everything but the number of cartridges in reserve—four as against ten.

It is a quicker gun than ours when all the firing is done from the magazine, as it is proposed should be done, and it has the advantage over the Mannlicher just pointed out, viz., that the magazine can be replenished without having had to be first emptied.

The weapon of the French Army, the famous Lebel gun, is nothing more nor less than the Kropatchek repeater, which has been for many years in use in their Navy. It has the modified Chassepôt or Gras bolt, and the spoon elevator common to all guns of that class; the sole change that has been made—so far as I know—in the mechanism, is a small stud or projection placed under the point of the spoon, which, when the latter is raised to conduct a cartridge into the gun, acts as a stop, and prevents a second cartridge from setting outside of the rear end of the magazine tube, and so jamming the action.

The faults of this system are known to you, I think, already. The danger of the long column of loaded cartridges bullet to cap has been minimized, as far as possible, by the introduction of a second, or safety cap, which, when driven in by the pointed striker, will produce an explosion of the cap proper; but may be driven in by a rounded surface, like that of a bullet, without doing so. The weapon has been re-christened partly, because it now carries the Lebel cartridge, which is said to produce an initial velocity of over 2,000 feet per second. Partly, also, I should imagine, because it is easier to say Lebel than Kropatchek, and, besides, sounds more patriotic.

Their satisfaction with this gun has not, however, prevented them from following the Austrian initiative in the new weapon proposed for the use of their cavalry. This is a gun having the Lee magazine and the clip system of feed. Oddly enough, however, they have gone a step further than the Italians have done, and place but three cartridges in their clips. This, of course, all but does away with any serious idea of cartridge reserve, and is merely a quick and convenient method of loading.

The Italian or Vitali gun is a conversion of the large bore single loading Vitali formerly in the Service. A Lee magazine has been added, into which four rounds are fed from the clip or holder in which they are issued. The gun is a clumsy looking affair, and I am unable to give you any particulars regarding its ammunition.

The Russians will retain, I believe, for the present their little Berdan bolt gun. They have proved to their own satisfaction, or at least to the maintenance of the confidence of their soldiers, that they are better off with the Berdan than they would be with any repeater; and to a certain extent this is, no doubt, true.¹

¹ Since I wrote the above, it has been announced that the Russian Government

Any advance made in the arm itself which in even the smallest way complicates its operations or renders its use more difficult will demand in a greater degree an increased intelligence in the soldier. And it is somewhat doubtful, not whether the *élite* of the Russian Army is ready for the magazine gun—that they are fit to be entrusted with any weapon goes without saying—but whether it would be advisable to introduce a superior weapon at the cost of many millions of money for the use of the armed but unintelligent peasantry who form so large a portion of their forces.

We have now in a general way disposed of the arms of Austria, France, Germany, Belgium, Italy, and Turkey, in Europe, and the Argentines in South America.

In the United States the Lee gun has long been issued to the Navy, where they consider repeating firearms to be even more necessary than on land. With regard to their troops they still carry, I believe, the old Springfield musket, which, in spite of much abuse and many attempts to displace it, has done good and useful service. You are all, of course, familiar with the gun: made on the principle of the Belgian Albini-Braendlin, it has yet a singularly American look about it.

Of course the Americans have their eyes open as to what is going on here, and they will, no doubt, as in the case of their big guns and big ships, allow Europe to have the expense and trouble of experiments, and when the proper time comes embody the results.

I have visited on several occasions the Springfield Arsenal, where these guns are made, and through the kindness of Colonel Buffington was able to see the whole course of manufacture. Some of the appliances are very beautiful, and there are some things done there which we might learn to do with advantage. For instance, the drop forging as it is called, of considerable-sized pieces of iron and steel. The forge fires, in which air charged with the vapour of petroleum is burned instead of coal or gas, where no scale whatever is formed on the iron and steel heated for forging or welding, where there is no waste and no damaged metal; the blueing of the musket barrels, which is effected by plunging them for a few minutes in a bath; a press in which the whole side of a field-gun carriage was formed from a steel plate in dies at a single operation; a press in which rings for carbines were formed cold, and bayonet sockets squeezed up to fit smaller barrels, the steel flowing under the enormous pressure like lead.

In making firearms, revolvers, or machine-guns, I fear we have still a good deal to learn from America.

In any case, as is well known, it is in this country sufficient that a man be an American for him to have attention in matters of small arms, seldom conceded to the domestic inventor. We owe the Sharpe carbine, the Colt's pistol, the Snider rifle, the Gatling, Gardner, and Maxim machine-guns, and the Hotchkiss quick-firing cannon entirely to that ingenious nation beyond the Atlantic. Americans have

is about to adopt a new rifle. Their re-armament will, however, take at least three years to effect.—G. V. F.

invented these admirable weapons, and created machinery for their production, and American workmen have taught us how to use it.

We are now adopting as our national weapon another little foreigner of the same birth and parentage, but if it only serves our purpose as well as its predecessors have done, we shall probably none of us complain that it was not produced somewhere near home, much as we might have liked to see it so, and here it is.

This rifle which I hold in my hand is the now well-known Mark I, one of the first batch issued to our troops; for all practical purposes an exact reproduction of the rifle approved by the Committee and sealed at the War Office to govern manufacture.

This is the rifle which has caused so much discussion and been credited with almost every fault it is well possible for an arm to possess.

I will not say that such of the writers and speakers as really understood their subject had not good cause for some solicitude or even alarm *from their point of view*, which was that every fault discovered in the guns first issued necessarily meant a permanent defect in the chosen weapon of the Empire. If a mainspring broke or a bolt head came off, a cartridge jammed or a magazine spring weakened, they argued that such accidents involved some grave error in first principles, and called out that it were better at once to abandon so faulty a gun.

I am not at all sorry that this view was taken or that such adversaries as entered the lists against it *honestly* were of such weight and influence, and spoke and wrote so powerfully and well, that the authorities were induced to reconsider some points they had thought permanently settled to relax somewhat the Medo-Persic conditions that surround and protect their sealed patterns, and admit that even at this early stage of proceedings Mark II might be made to succeed Mark I with advantage to the gun and the country.

They have thus done us a signal service, and one for which without them we might have waited for years.

I do not hesitate to say, however, that had they not wisely refrained from continuing the attack after winning their first battle, had they succeeded in arousing the fears of the country and stopping the manufacture of the weapon, they would have left us practically without arms of modern type for two years at the very least, and perhaps landed us in some grave national misfortune.

The reports of the Committee who selected and superintended the improvement and testing of the gun are not accessible to outsiders like myself; but it is known that a typical Mark I has fired 10,000 rounds, and remained good and serviceable; that it has lain for a month out of doors in wet and wintry weather, and, rusted as it was, been worked and fired with success; that it has stood the tests of sand and acids, ill usage, and damaged ammunition, in a way to prove its fitness to resist more complicated misfortunes than could possibly be the lot of any single gun under any circumstances whatever. Perhaps some objector will say, as indeed I heard said the other day, that its mechanical principles are all wrong. To which I

reply, then so much the worse for the mechanical principles; if, indeed, they are really concerned in the matter at all, which I am somewhat indisposed to admit.

Some wire may not be bent into the most effective shapes, a set screw might with advantage be replaced by a better contrivance, but I maintain that there can be nothing very radically wrong in a gun which will stand triumphantly the tremendous tests to which this very Mark I has been subjected, and in which it has beaten every competitor. Mark II will, among other things, be lighter, which is a great gain. It will not have a locking bolt, which is a matter of but little importance, as it can be cocked or have its firing piece let down by hand. It will, I hope, retain the dust cover and the long-range sights, which, by-the-bye, I should like to see placed on the right side of the gun; but Mark II, when first issued, though an improvement on Mark I, will yet not be the perfect weapon which Marks V or VI may confidently be expected to become, when we arrive at that stage of the matter later on.

I should much like to have been able to exhibit here a certified sample of Mark II, in order that you might have been able to compare it for yourselves with Mark I, but that being impossible, I have an uncertified copy which you may take as being a very close representation of the real thing, of which but few have been yet made, and which is said to be still in the experimental or unsealed stage. You will easily see most of the changes that have been made, but would hardly notice one of them which, with the general lightening of the weapon and the adoption of a better attachment for the bolt-head, form the three great advantages obtained for us by the criticism above alluded to. This is the change in the magazine, which, slightly broader than before, is also slightly shallower, and contains ten cartridges instead of eight. We must remember that these are a first instalment only of the improvements we shall get by-and-by. Nothing very startling to look at, I daresay, no change whatever in principle, but little subtractions and additions to the parts; small changes of form which add to the smoothness and certainty of their working, and remedy the minor faults which come to light in everyday work and as we get to know the weapon better.

But why, you would ask, if there is a single fault remaining, is the rifle issued? Why, when the specimen of which you speak has stood such terribly severe tests with success, are we to find, the moment the issue of these arms commences, a number of accidents occurring, which would have been sufficient to disqualify the original rifle from further competition?

To the first question, the reply is easy. Had absolute perfection been insisted on, you would never have got a rifle at all. The very best gun is but the result of a series of compromises; and it is only from experiences gained by having a large number of rifles in all sorts of hands that every fault can be detected for future remedy.

To the second, the conditions under which the trial rifles were produced were totally and essentially different from those which

attended the manufacture of Mark I. They were produced by the most highly skilled workmen, slowly, a bit at a time, under the eye of the inventor. Their springs were tested and re-tested, any weak portion renewed or remodelled, and, so to speak, they were nursed into existence. But when once the type had passed its tests, obtained its diploma, and been furnished as a model for 100,000 exactly similar guns, a totally new set of conditions came in. A new set of men took the matter in hand, and other means had to be used for the making of every bit of them. The problem now came up for the first time for solution, how to deal with many tons of steel in such a way as to best make them into the bolts, the shoes, the barrels, the guards and bands of these new guns; what metal shall we draw into wire and of what diameter, and how shall we coil and temper it wholesale, so as to make a mile or so of it into mainsprings—and mainsprings, too, which, while of smaller diameter than usual, will yet work smoothly and evenly, and neither lose their elasticity with constant wear nor snap on a sudden strain either at 150° above or at 40° below zero. Moreover, none of this is work which can be performed off-hand in either the best or the cheapest way.

During the whole course of manufacture, constant little ways by which one operation may be made to take the place of two will occur, a third perhaps being dispensed with altogether, so that by-and-by, and in the natural course of things, the next issue of guns will be found to be better made and cheaper than the present.

As to the mainsprings, the coiling and tempering of wire springs is a trade by itself, and a trade, too, which, more than any other, has its secrets.

It is exercised in England by one firm almost exclusively, so far as the very best springs are concerned. And there lives in Belgium a little workman of my acquaintance who, from having a small shop when I first met him, and working for his neighbours, has arrived at a large factory, and works for every Government. He keeps the key of the tempering shop himself, and no one but he ever enters it or works there.

And yet our arms manufactory is expected to do at a moment's notice, and without a single failure, what it has taken this man a lifetime to learn, and what he himself could not do off-hand, and without serious consideration of all the conditions, and of the material it would be wisest to employ.

Is this quite reasonable? Does nobody recollect the early days of the Martini? How mainsprings broke up like glass; how irresponsible persons proved, to their own satisfaction, that the motions of the rifle violated every known law of mechanics; and how learned professors were engaged on either side in a controversy which seemed never ending? But one fine day we woke up to find, to our astonishment, what all the rest of the world already knew very well, that we had in our hand the most powerful far-reaching and deadly soldier's gun in existence, which, from Mark I progressed to Mark VI, I believe, in our own factories, and was still further improved for the Roumanian Government by the celebrated Austrian manufac-

turer, Herr Werndl, of Steyer—the story of which, as showing what can be done with firearms, is worth repeating.

The Roumanians, who not then being manufacturers of ammunition, and knowing that—specially in their fortified places—they might have to use the empty shells over and over again, adopted the Gatling-Gardner solid-drawn case: and extraction also being the weak point of the Martini, resolved to meet both conditions by a single order to the inspectors charged with the reception of their rifles. They determined the exact size of chamber into which the cartridge they had chosen would expand and again recover itself; and they gave the order "*Point de tolérance*" "no allowance," which practically meant that a deviation of a thousandth of an inch from these proportions would condemn the gun.

The large German firm which had taken their contract with a light heart was promptly ruined, as might have been expected, and closed their doors. At this point Herr Werndl stepped in, undertook and fulfilled the contract under these onerous conditions, and made the Roumanian Martini the best specimen of the gun in existence.

I once had three of these rifles, and the fired shells would fit indifferently the chambers of all three without re-sizing, and in all the thousands of rounds I have fired with them, I never once had the very slightest difficulty in extraction.

I mentioned this fact once before, and the reply I then got was that the chambers may have been all right; but how about the cartridges, they could not have been all exactly to size? Probably not; but a cartridge if not exactly to gauge is always above and not below it. Owing to the wear of the dies, too much, not too little, difference between chamber and cartridge is what would produce a stick.

This said question of rigorous exactitude in the dimensions of the chamber is of the greatest importance to any rifle, more especially now when, as in our own, higher pressures will be generated by the new explosives, and a cartridge be liable to be permanently set up in a chamber in the smallest degree over gauge, and cause endless trouble.

No doubt, however, attention is being given to this and other points which I need not here mention.

There is, however, one other subject which I should like to touch on before I conclude, viz., that of the bullet and the rifling. I introduced some eight years ago, as some of you I daresay know—a system of short rifling for sporting guns, which, rifled at the muzzle for about an inch only, carry ball with the accuracy of a rifle and fire shot as well as an ordinary gun.

A thousand barrels or more have now been made on this principle, and, as you will see from the targets here, at the distance they are intended for, they shoot very well indeed, and the correctness of the principle has been thoroughly vindicated.

I have here some casts of the muzzles of such guns 8 and 12 bore, and though we get but little increased velocity, as some would suppose, it is evident that a good deal of the work done in barrels rifled for their full length is dispensed with. This for arms of these

large calibres is a matter of but little importance, and forms no part of the reason for making them, but when we employ such diminutive tubes as this of which I have here a cast, in which the bullet has to perform three distinct turns on its axis accompanied by a vast amount of friction, it does seem to me that it would be worth while to ascertain whether a few inches of rifling, in which a little angular displacement only would be required, might not serve as good a purpose, and whether in such a case a simple hardened bullet might not be employed, and some 75,000*l.* per annum be saved to the country, which sum represents about the cost of the nickel-copper envelopes which will be fired away year by year in our annual practice.¹

To return, however, having thus far spoken of the arms which I have undertaken to examine and describe, I will now, if you please, proceed to compare them, one with another, and see whether in the adoption of this new rifle, we can be said to have abandoned or maintained our position as to small arms, which in the days of the Martini-Henry was at the very top of the list, *facile principes* we then were in this matter, beyond doubt or cavil.

It is interesting to note in the German rifle what advantage has been taken of the forward position of the locking wings on the bolt to lighten away everything behind that point. Even the magazine is of extremely thin steel, but it is brought up to the requisite degree of strength by these ribs which you see on each side of it, and which also reinforce the trigger-guard, itself but a thin ribbon of metal.

The Austrian is the heaviest of the four guns more immediately under consideration, being more than 9½ lbs. in weight; and I think you will agree with me that a soldier's gun should not exceed 9 lbs. in weight, or with bayonet fixed, 10 lbs.

Mark II will be well under these weights; but here we come to a strange divergence of opinion, as evidenced by the present state of the bayonet question; the German gun, with bayonet fixed, being no less than 13·4 inches longer than our own, and the French 10·1 inches; perhaps if we had put it the other way, the statement would have explained itself. The French have retained the long bayonet of the Kropatchek, now a very old gun; and the Germans are minded in this matter to over-reach them.

The Austrians, on the other hand, have shortened their bayonets even more than ourselves; and whereas their rifle is an inch longer than ours, the rifle and bayonet together are more than an inch shorter.

That any great combat will ever be decided by the fact that the bayonets on one side are 3 inches longer than those on the other, I must say I do not believe. Bayonets and rapiers are very different things; and the issue in the former case will not depend on the mere presence or absence of an inch or two of steel at the business ends of them.

¹ The late Captain O'Hea many years ago advocated what he termed "part-rifling," and though he was successful in some experiments, for some reason the thing fell to the ground. My construction is somewhat different from his.

The bayonet push is a thing almost unheard of in war. The bayonet rush, as a rule, decides the weaker nerves to go. Still all must carry them in some shape or another as long as any do. Imagine the continual annoyance troops would be subjected to were they known to carry no bayonets. They would be charged by everything that could ride, mounted infantry included, and all the world would be unduly anxious to come to close quarters with them. As this is so, no doubt a short handy bayonet is the best weapon to have at the end of one's gun for a single-handed fight with a savage sword or spearman (which now and then comes off), and interferes far less with the shooting of the rifle, which must always precede any such episodes at close quarters.

With regard to the merits of the different rifles as single loaders so far as their mechanism is concerned, I should be disposed to place them much on a par one with the other. There may be a shade of preference for the German forward locking bolts, but these again have their disadvantages, the slots in which the lugs work are away out of sight and must form receptacles for a good deal of dirt, fouling, and rust which it would not be easy to get rid of. Nor can the cartridge itself, should the head blow off, for instance, readily be got at and extracted as with us. There is, however, I think no doubt that the outer protective barrel is an advantage of considerable value.

The system looks well, but if report is to be believed there have been accidents, and grave accidents too, with this gun, as indeed will inevitably take place with a first issue. Only in Germany, the Press is not permitted, as with us, to depreciate the weapons on which the safety of the Empire may depend, and such misadventures as I allude to only reach the ears of the most careful enquirer.

The Germans have found a great increase of accuracy with their new small-bore guns, and, in consequence, have diminished the size of the objects aimed at, or increased their distance.

That we have not the same improvement to note, as some folks are disappointed to find we have not, is entirely the fault of our last Committee on small arms but one, which in the *Martini-Henry* gave us a small arm as accurate as it is, I believe, possible to make one by machinery and in large numbers. Our Martinis were far ahead of their Mausers in this particular, and if they have now come nearly up to the shooting of the Martini, as is possible, they will not be very far behind our own rifle.

If then these four guns, the Austrian, Belgian, German, and English rifles, as to weight, safety of construction, and accurate shooting are somewhat about on a par with one another—I omit the Lebel and Vitali, for on the accuracy of their shooting I have no information—the whole question of the merit of the arms of Europe will turn on the magazines attached to them, which are indeed their *raison d'être*, and on the uses to which they will be put. And here I do not hesitate for a moment to say that I consider our own system so vastly superior, as to place our guns far and away ahead of all the others. We agree with the French, that the thing to be sought for is not a trifling acceleration of fire above that of the single loader for

ordinary occasions, as all the others seem to believe; but a certain and reliable store of strength with which to meet the extraordinary occasions which specially in modern war are certain to arise, and equally certain, should we or our weapons be found wanting, to overwhelm us.

The French provide against their moment of necessity nine cartridges arranged in a tube under the barrel of the Lebel, easy enough to empty, but difficult and tedious to refill.

We provide ten rounds in a centrally placed detachable magazine which can in five seconds, when these are expended, be replaced by a full one carried in pouch, and we have thus a reserve for emergencies of twenty rounds. What more will any one say he wants?

Yet even so usually good a judge of things military as Mr. Archibald Forbes cannot help turning out of his way in his recent, somewhat fanciful article, on the "Warfare of the Future," to sneer at what he calls the Lee-Speed, and deny its right to the confidence of the soldier.

I venture to assert, on the contrary, that no soldier to-day carries a small arm that when the first difficulties of manufacture, *en gros*, shall have been overcome, will make a more magnificent record as a weapon of war, and that the first fighting that shall occur—and allow a fair comparison to be made between the arms we have examined to-day (not at the desk or on the rifle range, but in the camp and the field), will justify, and more than justify, the position I have taken regarding it.

Inventors, whose disappointments have introduced so much bitterness into this controversy, but whose complaints have rather taken the form of carping at minor details and remediable faults, than of any bolder challenge of the rifle on general principles, must be contented, for a time, at least, to find their occupation gone. The choice we have made is, for the moment, final; we shall retain, though we may improve, our rifle, until such time as the march of science again calls, as it did nine years ago, for something more rapid in its action, more far-reaching, or more deadly. But to-day, no system exists so good as our own, and though in several weapons there may be trifling advantages of construction, there is absolutely nothing which would make it even good policy—to say nothing of economy—to reject the machinery set up for the production of our gun or recommend the exhaustive trials which could only justify, at the end of two years or so, the adoption of a new one. The probabilities are that, as we can now fire forty rounds in a minute from the shoulder, and 650 from the machine-gun, we shall not move again till the possibility of much exceeding these results is demonstrated, or the means of obtaining them made easier.

Whether we shall then take up the left hand motion of Gardner and Spencer, use the recoil to do our work as does Maxim, or incline to listen to an inventor whom I met in New York who first filled his gun with ammunition, and then wound it up like a clock, I don't at all know.

For preference, I should say that some variety of Maxim's prin-

ciple, wedded to the electric cartridge of Pieper or Day, will stand as good a chance as any.

I shall, probably, however, not live to see it, or again feel myself called upon—as I did when I last appeared in this theatre—to urge you to change the rifles of the English Army for something newer and better, lest in the great race of progress you should one day find yourselves either distanced or left behind, and be made to suffer accordingly. For the present you may rest satisfied to know that our soldiers of to-day hold in their hands the best military small arm in existence.

Captain W. H. JAMES : I am sure we are all very much indebted to Colonel Fosbery for the very excellent lecture he has given us this afternoon, and also for the display of weapons he has brought here for our edification. I think we are also indebted to him for his concluding words, in which he expressed what I believe to be the opinion of most who have studied the question, viz., that although the present rifle may not be an absolutely perfect one (in which it differs in no wise from most other human institutions), it is in itself a very excellent weapon, and that in all probability future improvements, which will not be difficult to make, will render it still more perfect. There are one or two points to which I should like to allude, and the first one is, the apparent enmity, if I may use the expression, of the lecturer to the clip system of firing. He says that, when you have the clip system of loading as at present obtains in foreign arms, you have only five cartridges at the most in your magazine. I maintain that that is not at all dependent upon the actual clip form of loading, but it is dependent on the form of magazine you use, to take that which the clip provides for it. Then he also says you cannot ascertain the number of cartridges that may be in the magazine. Well, so long as you use the magazine merely for a specified moment, which moment I think is one that each individual soldier is very apt to interpret for himself in accordance with his own conception thereon, so long as you use the magazine only for this purpose of intensifying the fire at the supreme moment, the system of single loading combined with the magazine, such as we have in the Lee-Sniders or other weapons, has advantages; but there seems to be a good deal to be said on the other side, namely, the accelerated rate of fire which you get by the use of the clip system as used by the Austrian, German, and Belgian armies. There is a great deal in having no extra thing for the soldier to do at the supreme moment. Where you have the clip system, the mere mechanical operation of loading the rifle puts five cartridges into the magazines instead of one. The soldier has not to think of the cut-off, which he has to pull open in order to use the magazine; and it seems to me a very moot question indeed whether the view which is taken by two great military nations at least, and the French are really coming to the same view—whether we have not to consider, with a certain amount of respect, the opinions which they have put forward and practically adopted in their weapons. I personally think that the clip system of loading has a future before it, and that it is the form which magazine weapons will eventually take. I think it is quite possible to combine the clip system with a magazine cut-off. That can be done with the Belgian Mauser, where you can load one or two cartridges or the whole five from the clip. You can have that combined with the ordinary system of cut-off. I think if you have the two combined, it is certainly better than the mere magazine alone, and personally I should be prepared to go over to the clip at once. I think that in the present weapon there is a mistake in the smallness of the mainspring, and I believe that people who have considered this subject do think that the mainspring might have been made more on the principle of that which is used, for instance, in the Belgian Mauser. Then with regard to the bolt. I believe also that there is a consensus of opinion in favour of having the lugs nearer the end of the barrel rather than at the man's end of the shoe in which the bolt works. I also think that the old Lee bolt and our present Lee bolt have one objection of considerable weight, that is, the difficulty in closing the breech. Very considerable force has to be used in closing the breech; and although this may be nothing in target firing,

and nothing in ordinary drill, when you come to situations where a very large number of cartridges are fired—and a very large number of cartridges will inevitably be fired by soldiers in a modern battlefield, especially in the defence of positions—I think it would be detrimental to the man's hand, very apt to bruise it and make it tender. Just in the same way we know that with the Martini, where the recoil is great for the weight of the weapon, the man's shoulder did get bruised if he did not take care how he fired. With regard to the question of straight action, I know there are objections to the Mannlicher straight action; but there is this solid fact, that the Austrian Army has adopted it. I differ from the lecturer on one point, when he says that there is no advantage in the straight action; there is most certainly where the rifle is at all raised. Supposing a man is firing from a sheltered place, he could most certainly fire more easily with the straight pull, because he has not to turn the bolt, which is awkward to do when the rifle is at the shoulder (illustrating), for he has to turn the bolt through part of a circle. With regard to the rifling, I must say that it is a point on which I feel very strongly. We all know that a very important member of the Committee to determine these things was Sir Henry Halford, who has always been a great advocate of the Metford rifling. I have not the slightest doubt that for the purpose for which the Metford rifling was introduced it was perfect; but the Metford match-rifle, with its increasing twist and large diameter of bullet, was a very different weapon indeed from the Midland small-bore rifle. It does not follow that because the Metford rifling¹ is good for the one that it is good for the other. The reports of Committees are not in England accessible to the outside public; and I must say that in a democratic nation like ours, the War Office is apt to forget that what it is paid to do is the work of the nation, and that the nation has the right to criticize that work. I think it would be better, therefore, if reports of this kind, on which the very existence of the nation may depend, were more accessible to the public than they are at present. I am led to make these remarks, because in the records such as are published—and goodness knows they are extremely bare and misleading—it seems to me that the question of rifling has never had due consideration, and that the question of part-rifling appears to be dismissed in a mere phrase. So far as I have been able to ascertain from the public records of the Ordnance Select Committee, there were no real serious experiments made to see whether the defects which the modern small-bore military rifle has as to its present form of rifling, could not have been totally eliminated, by the adoption of part-rifling. I still hope we may have experiments in this direction, because that will not involve any alteration except in the rifling of the barrel. You might use the same weapon, the same cartridge, and the same bullet, and everything as far as dimensions are concerned. You have only to see whether the part-rifling is not better than driving this unfortunate bullet up the long lane with three turnings in it through which it has now to go. That length cannot be necessary for accuracy, because, if that be the case, I should like to know what length we should get in the case of the 110-ton gun. The weapon would be as long as the ship. The actual length of barrel is not necessary for accuracy, and therefore, if that be the case, it always seems to me there can be no reason why that portion of the rifling which is not necessary for that purpose should be left smooth. If this were exhaustively tried, I venture to say we should get a very much easier solution of the cartridge question. Some time ago I saw a very ingenious amendment of the magazine by Mr. Morris, of tube fame, and that was one side of the magazine pulled down, and the cartridges all loaded in at the side. It was a mere modification of the present Lee magazine. It seemed to me a very good one, and tending to rapidity, and to do away with a point which I personally think is a mistake in the present rifle, and that is the detachable magazine. It always seems to me that detaching the magazine was a yielding to the clamour of people who did not want the magazine at all. If the magazine is detachable, it is likely to be lost. You had better make it an integral part of the weapon, such as the bolt or the stock. No other nation has adopted this form. It is absolutely unnecessary with the clip form of loading, and I think myself it is a grave defect.

¹ The actual "cut" of the grooves in the Metford rifling is, no doubt, the best.

Major P. T. GODSAL: The lecturer spoke slightly of those who base their criticisms of the Government rifle upon mechanical principles. I beg to join issue with him upon that point, for I should be sorry to have it supposed that I have ever used any arguments against the breech action of that weapon, except such as are based upon mechanical principles. How can a piece of mechanism be judged otherwise? I do not wonder at advocates of the breech of the rifle in question upholding empiricism pure and simple, since all that can be said in favour of that rifle is that, thanks to the superlative excellence of its manufacture, it has passed the ordeal of several very severe experiments. The Martini was quoted as an instance of the triumph of the empiricists over mechanicians on principle, but it furnishes a strong illustration of the opposite. When the Martini was issued, was it ever admitted that the extraction was weak? Nay more, such confidence had experiments given in the power of the extractor, that it was never deemed possible that the cleaning rod would be required at times to supplement its action, and so a large knob was left on the cleaning rod to prevent its being used to knock out sticking cartridges. Fortunately for us, the Turks copied our rifle, including this absurd knob, and only their bitter experience in the Russian War taught them and us to have it filed off. Who in this case was right? The men of principle, who on the first appearance of the Martini pointed out that, as its levers were all the wrong way the extraction must be weak, or the empiricists who said that countless experiments had proved it to be all right? To wind up, the rifle advocated by the mechanicians of those days was adopted, and is still preferred, by those practical riflemen the Boers, and comparatively good as the Martini is, we might have had a better gun. But to come to the present time. It is hard to blame critics because they cannot afford to carry out costly experiments, and are unable to obtain more than a casual glance at the Government rifle; but, in spite of this, they have so far proved to have been right, and their contention that only the highest perfection of manufacture would enable the breech mechanism of the magazine rifle to work, has not so far been proved to be wrong. The Government weapon should have the fullest favour accorded to it. No one would be so unpatriotic as to wish it to prove a failure; but it would be still more unpatriotic to attempt to conceal weaknesses that must be evident to every foreign expert. The breech mechanism in question violates the principle that the dimensions of the closing piece should be governed solely by considerations of the strength required. It is an axiom that a mechanism like the breech of a rifle should be simple, and that each part should perform its own functions in the simplest manner without interfering with any other part. Yet apply this to any single limb. Take the extractor, for instance, that depends for its work on the accurate dimensions and absence of wear of several parts. First of all, a cam on the bolt strikes on an inclined plane on the breech shoe; this makes 2 parts. The bolt then pulls at the bolthead screw (3 parts), that pulls the bolthead (4 parts), that pulls the extractor pin (5 parts), that pulls the extractor (6 parts); the extractor has to be actuated by a spring (7 parts), and the whole has to be supplemented by an ejector cut in the breech shoe. The whole mechanism is open to much criticism, and gives mechanicians grave cause for anxiety. Let us hope that all will be well, and that their fears will not be realized in warfare, as they were in the case of the Martini, but that we may really get the best possible breech mechanism.

Colonel C. SLADE: As a member of the late Small Arms Committee that recommended the Government rifle for adoption, I may say that I am extremely pleased with what has been said, and congratulate and compliment Colonel Fosbery not only on his admirable lecture, but also on the calm and impartial way in which he has dealt with his subject, not only in dealing with our rifle, but with all the foreign rifles. The excellent account he gave us was couched in very admirable and intelligible language. There are one or two points on which, with his permission, I would correct him, and I may say I speak with some knowledge of this subject, because, since the rifle was first conceived, I have had it under my personal supervision. With regard to the spare magazine, I would correct him on that point. We have given up the spare magazine: at present it is not carried by the soldier. It was considered, after very careful inquiry and threshing out of the subject, that it was an extra article of equipment, and liable to be lost, and therefore it has been

done away with. As to the accuracy, Colonel Fosbery rather hinted that, though the Germans had found great increase in accuracy, we had not quite the same improvement. Now, I must beg leave to traverse that statement most entirely. There is no military rifle in Europe that can compare, as far as my knowledge goes and from what I can gather, with our rifle for accuracy. The mean deviation of our rifle at 1,000 yards after a long series of experiments was very little over 1 foot. Strange to say, only this morning I received a record of three shoots made with a Government rifle two days ago at 500 yards, and out of the twenty-one shots two only were 4 inches from the bullseye. The size of the bullseye was, I think, 1 foot. I do not think any military rifle can compare with our rifle for accuracy. As regards rifling, I have no hesitation in saying that it is the easiest rifle to clean of any rifle that has come under the notice of the Small Arms Committee. As to the wear of the rifling, I may say that some of the barrels have stood upwards of 8,000 and 10,000 rounds without visibly deteriorating. One barrel stood 3,000 shots from a steel bullet, and the barrel was not injured; therefore, I think, as regards accuracy and rifling we have nothing to fear. I do not know whether I shall be quite justified in saying anything about the actual trials which have taken place with the rifle, but I may say that for the last fifteen months I have had our rifle under my own personal supervision and care, and I have seen it in the hands of Officers, non-commissioned officers, and men during that period, and although in the first issue a few mainsprings, or rather, I may say, a great many mainsprings, undoubtedly did break, that was entirely due, not to the faulty principle, but to the faulty tempering of the metal. During the last three months, out of 200 rifles not one mainspring has broken, and they have been in daily use in shooting, drilling, and have been snapped and fired thousands of times. Therefore, personally, I am confident that the mainspring is perfectly sound in principle, and that we have nothing to fear. With regard to the magazine spring, I may say that I think the new magazine spring is perfectly sound. Within the last month, I have failed in my attempt to break down the magazine spring, and have failed in attempting to break down the rifle. The rifles have been left with the magazine loaded day and night for fourteen days; they have been covered with sand and water, and have been thrown forcibly and violently time after time on to the stones, and they have fired thousands of rounds. The rifles have stood these tests, and they are just as good as they were the day they were issued, and nothing has gone wrong. As I said, I failed in my attempt to break the rifle down: whether other people will be more successful I do not know; but, as regards the attacks that have been made on paper, I think they have perhaps been carried rather too far. I firmly believe myself, simply from trial and not from any theory, that the English rifle, as Colonel Fosbery has said, is the best military rifle in Europe.

Lieutenant-Colonel FOSBERY (in reply) said: Captain James takes exception to what he calls my enmity to the clip system; but I can assure you I have no enmity to the system; the objection I have to it turns on its failure (as it is now made use of) to carry out the original purpose for which magazine rifles were made. It is now used simply to accelerate their fire on all occasions: and it does not give them that reserve—that effective reserve which I have all along maintained, since I first spoke on the subject, should be at the least ten rounds for an emergency. As for the soldier being allowed by his Officer to constitute himself the judge as to when it is best to open his magazine, and act on that judgment, all I can say is, if we are not able to impose and maintain proper fire discipline, the less we have to do with such guns the better. It is well known that section leaders, if properly instructed and drilled, can maintain a fire discipline sufficient for all practical purposes, and that, in actual warfare, such a thing as any entire breaking away from control by the men would be exceptional. Again, Captain James has suggested that we might have the clip system, for carrying and handling our cartridges, and loading them into the magazine, and use the cut-off also. But I have already pointed out, while advocating the use of the cut-off, that it would be a great advantage to us did we employ some better means of filling our magazines. It is the cut-off that I insist on; it is not so much the method of loading the magazine, as the use that is to be made of it when loaded, and the time at which that use should be made; that is to say, let us load with clips, if we will, but let us reserve our

store of ammunition for emergencies, not expend it to accelerate, by a round or two a minute, the normal rate of fire of the rifle. With regard to the smallness of our mainsprings, we are not in the same position as are the Germans. They having placed their locking wings at the head of their bolt, the remainder of it can be cut out for any sized mainspring you choose to put into it, as the rear end of the bolt has not to support the recoil; whereas we, supporting as we do the recoil on the entire bolt, must naturally have thicker walls to give us the needed strength, and, consequently, less room for our springs. Furthermore, though what has been said was no doubt true of the springs of the first rifles made, which did break, we now learn, from what Colonel Slade has said, that this is no longer so. Means have been found for so coiling and tempering the springs that, even in the restricted space we have, they work freely and well, and without danger of breakage. Again, I myself stated that it was a moot question which time was the better for the compression of the mainspring to cock the gun, that of opening or that of closing the gun. There is more than one reason why it is better not to do so while opening it: if you do, you are doing two things at the same time, both requiring considerable force, and neither being effected by the best possible mechanical means; the one is the setting in motion the cam for starting the cartridge in the chamber, the other the compression of the mainspring by a second cam or inclined plane. In the Lee you have merely to start and withdraw your cartridge. I think, therefore, there is something to be said on both sides, while at the same time quite admitting the force of what Captain James has said—as, indeed, I have already done in my lecture as to the straight pull-out—with every respect and deference to the Austrian Government, or those responsible for its adoption, I cannot admit that all means for starting the cartridge can safely be omitted in a military gun—even with the best chambering it is possible to make. I have read a description of this gun, in which it is claimed that a hammer action is set up by the method of withdrawing it, which supplies the place of a starter; this, however, is not the case, as the spring is being set in compression during the first part of the pull, and this makes the pull on the bolt continuous, and no such action can take place; at least such is my opinion, and I think M. Mannlicher, in adopting this straight pull-out, sacrifices a good deal more than he gains. The Metford rifling is a very easy, clean rifling, and though only, I think, some three thousandths of an inch in depth (perhaps Colonel Slade will here correct me if I am wrong), gives a wonderful hold of the bullet, half the circumference of the bore being active rifling surface.

Captain JAMES: I do not think I advocated a more severe rifling; I merely queried whether it was necessary that the Metford rifling should be continued through the whole length of the barrel.

Lieutenant-Colonel FOSBERY: It is quite possible that half or two-thirds of it might be done away with.

Captain JAMES: Or nine-tenths.

Lieutenant-Colonel FOSBERY: Yes; and in such a case you agree with me as to the advantages we might expect to obtain. With regard to the Morris magazine, I do not think I have seen it. In describing the Mauser rifle, I forgot to say that it has a magazine, which is detachable, though not easily so; it does not form, as with the Germans, an integral part of the weapon. The Mauser, as I said before, has been adopted by the Belgians, the Turks, and the Argentines. I think these are the main points on which Captain James touched. With regard to Major Godsal's remarks on mechanical principles, I think all the world admitted that in the Martini-Henry the leverage at our disposal was not used to the best advantage; but that it was susceptible of improvement, and, as a matter of fact, was improved, and does its work effectively and well. After all, it comes to this: the proof of the pudding is in the eating, and, taking it all round, with a good cartridge and a proper chamber, it is an exceedingly good soldiers' weapon. No doubt whatever about it. Nor do I exactly see the force of Major Godsal's criticisms on the mechanical faults of our new gun. He says one thing pulls another thing, and again that thing pulls something else; but, after all, this is the principle on which all these guns are constructed. The handle pulls the bolt, the bolt pulls the head, the head pulls the extractor, the extractor the cartridge, and so on. In all these guns that I know of, with one exception, the bolt has a movable head, and in all

but Major Godsál's own gun the extractor is attached to the bolt; in these respects we are no worse off than others, while the construction of the head of our bolt is better than that of any rifle I know. I do not see where strict mechanics come in to all these things, though no doubt the gun illustrates certain mechanical powers, as, for instance, here is a lever which actuates a cam or portion of a screw to start the cartridge, and a very good application of mechanics it is. But as long as the gun works easily and well, and resists complicated ill-usage in the way this (Mark II) gun does, even supposing all the mechanical principles in the world were absolutely violated in its construction, I do not see why anybody need complain.

Major GODSÁL: I merely said that we are bound to argue on mechanical principles, because we cannot afford the expense of making experiments.

Lieutenant-Colonel FOSBERY: And I reply, that if the gun is a good one, and the mechanical principles are all left out in the cold, so much the worse for the principles.

Major GODSÁL: I said, the question is, Could you not have a better gun?

Lieutenant-Colonel FOSBERY: I duly note Colonel Slade's correction of my statement as to our troops carrying an extra magazine. Lee's original idea was to have all cartridges served out in little magazines, containing five rounds each, and which were fitted into the gun one after another. These the soldier was to carry in various ways about his person—a thing which in practice became quite impossible, and which the clip system entirely superseded. I, on the other hand, have always maintained that one essential of a magazine gun was that it should contain a reserve of ten rounds, for use in any emergency, and now that this is assured to us, and that we have a gun which will fire them as our new gun can, I, for my part, am content.

General Sir M. DILLON: Colonel Fosbery has left nothing unsaid in his lecture on the magazine rifles of the Great Powers of Europe. From statements which appeared in the newspapers, and discussions with experts, I was prejudiced somewhat against our new small arm; I thought the German breech action of simpler construction, but Colonel Fosbery has dispelled my misgivings. On active service, in 1863, he began experiments with explosive bullets, and then took up the study of military rifles, to which he has devoted himself. He has visited Russia, Germany, Austria, France, Italy, Belgium, and America, working with his own hands in some of their small-arm manufactories. Few have had his experience, and there are not many who can speak on the subject of small arms with his authority. He has placed before this meeting the magazine rifles of the military nations of Europe, has shown us their breech mechanism, and described the advantages and disadvantages of each of their arms, including our own. The deductions which may justly be drawn are, that we are not behind any nation in our small bore, and that when the smokeless powder, which we possess, has been brought into use, we shall be in advance of Europe. Distributed as our forces are, over our vast possessions, we dared not to introduce this powder without thorough investigation and experiment, as to the effect on it of time, damp, cold, heat, and of rough usage. Colonel Slade has referred to the trials to which the new rifle has been subjected; the new powder has also been tried, and has endured the trial excellently well. Colonel Fosbery has referred to the dagger which has been substituted for the bayonet. We should not legislate for civilized warfare alone. We have been engaged in wars against barbarous peoples for many years—brave men who would close with their enemy rather than trust to firearms, on which European armies rely. We have met Kaffirs, Zulus, Soudanese, Burmese, the tribes on the eastern and north-western frontiers of India, and Afghans, besides Persians, Abyssinians, and Ashantees, within the recollection of many here present, and few of us have not known or heard of instances in which soldiers have had to use the bayonet. An expert would, with the new rifle and dagger united, overcome an ordinary soldier armed with a longer bayonet; but we have to consider the Army as a whole, and we should send our men into the field, each man with full reliance that he is as well armed as his enemy. On an occasion when ammunition had failed—and ammunition will fail at times—the Zulus described how the "long assegai" of our men (rifle and bayonet) had kept them off with their shorter assegai, and how they then threw

their assegais, and so destroyed their enemy. The Germans, as we read, are returning to a longer bayonet. We should do so. You will unite with me, gentlemen, in offering our grateful thanks to Colonel Fosbery for his admirable paper, full of valuable information on the great question of the day.

Friday, May 22, 1891.

ADMIRAL SIR W. HOUSTON STEWART, G.C.B., Member of Council,
in the Chair.

MASTS AND SAILS AS A MEANS OF TRAINING.

By Captain CHARLES JOHNSTONE, R.N.

THE CHAIRMAN: My friend Captain Johnstone, who is so well known in this institution, has, with that care and ability which, from early acquaintance with him, I know he bestows on anything that he undertakes, prepared a paper which speaks for itself, as being of very great interest to all naval Officers. I also think that it is of the very greatest interest to all by whom it is considered of vital importance that this country should remain as we know it was in the past, and as we believe and hope it is still, the great sea Power of the world. I now ask Captain Johnstone to read his paper.

THE subject which I am now about to deal with, is of such surpassing importance that it is only with reluctance I have taken upon me to bring it before this Institution. My unwillingness to do so arises from the strong feeling I have of the profound importance to this nation, of the decision which must shortly be come to as to the kind of man-of-war's man which is to be produced by the Navy in the future; coupled with a fear, that my own imperfect advocacy may imperil the cause which I desire to serve. But time presses, and an adverse decision might produce incalculable evil, before a wrong step could be retraced. The important question is, whether our seamen are in the first instance, to be trained in a manner closely approaching the old style, in masted ships, *i.e.*, in ships able to move and to be perfectly controlled under sail; or, whether we are to throw overboard entirely that part of our experience of the past, and start on a new system, in which our sailors must necessarily be persons of very different qualities from those of the men of earlier generations.

Towards the end of March last it was reported in the "Times," that the First Lord of the Admiralty, in reply to a question in the House of Commons, "was understood to say that it was in contemplation to abolish the Training Squadron, but that the opinion of Naval Officers on the subject would be taken." It is possible that at the present moment a want of men may furnish a reason for suspending the use of a training squadron; if this be the case it is earnestly to be hoped that the earliest possible moment will be seized for its re-establishment. On the other hand, should the paying off of

the squadron be merely a step in the abolition of practice in the use of masts and sails, I submit that it will, by a large and increasing body of Officers, be looked on with positive dismay, as a prelude to the immediate lowering of the high qualities of both Officers and men. Some of the advocates of the abolition of a seaman-like bringing up accept this consequence; but, when the falling off has actually made itself evident, it is more than probable that there may be a revulsion of feeling towards the use of masts and sails, and with it a resort to the usual lavish expenditure of means when a sudden change of public opinion has occurred. But who shall say that even then the lost ground can be recovered?

Submission to authority is a strong feature of the Naval Service, and it is probably due to this feeling that Officers, even those of experience and standing, are unwilling to put forward their views and to speak out their opinions on important questions. But it is to be remembered that it has been made abundantly clear that a proper discussion of such matters is approved and welcomed by the Admiralty. This, then, is surely an occasion for seamen to speak out, and it is earnestly to be desired that Officers of weight and experience should, without delay, make known their deliberate opinions on this important matter. Hitherto the advocates of the total abolition of masts and sails have had the field very much to themselves, in fact, of late years the question of the matériel of the Navy has mostly absorbed attention, and the care of the personnel—the moving spirit—has been generally left to run its usual official course. A notable exception, however, is found in the recommendations made by Admiral of the Fleet Sir Geoffrey Hornby, as to the training up of seamen. It is to my mind, nevertheless, unquestionable that besides the Admiral of the Fleet there are, amongst the experienced Officers of the Service—speaking of those who are in full contact with everything that is modern in the Navy—many who fully hold the opinion that training in masted ships is of great importance. Indeed, so far is the contrary view from continuing to impress itself on the minds of Officers that I have already heard of a convert from the abolition of sails-view to that of the necessity of bringing our men up as formerly—a convert owing to the experience of service in a mastless fleet.

It is difficult to say on this subject anything which has not been already stated in the clearest way by Sir Geoffrey Hornby in the "United Service Magazine" of August last, and in a subsequent number. With the very high respect entertained for the Admiral of the Fleet as a sea Officer, are we to think his opinions on this matter as worth nothing?

Could we have any confidence in a chief who was able to see only one side of the question of preparing the materials he was to put into operation, of training the men he was to lead into action? And can we think that any Officer whom we should rejoice to see lead one of our fleets into action, is incapable of judging how the seamen under him are to be formed?

In February last I had the honour of reading before this Institution a paper directing attention to the training of men-of-war's

men, and advancing the view that the practical difficulties in the way of giving adequate practice at sea to our seaman class men, renders it imperative that either a portion only of them shall be fully trained, or else that their total number shall be reduced. It was there pointed out that our modern ships do not require so large a proportion of regular seamen as they carry at the present day (provided the crew is properly made up in some other way); and that a century ago—in the sailing days—the number of seamen on board was actually less than in our existing mastless ships. From this was deduced the conclusion, that with certain modifications of our present system, it would be perfectly possible to train up a sufficient number of men in a manner calculated to bring out the finest qualities of the seaman of the past.

My object at the present time is to bring forward reasons in support of the view, that the experiment of adopting a mode of bringing up our men unlike anything known up to within the last few years, is a step of a very grave nature; and that the experience of the past does not afford reasonable grounds of anticipation of its success.

We know that in times past the qualities of our sea Officers and seamen were unsurpassed, either by foreign nations or by our fellow countrymen unconnected with the sea; it is an unassailable position that the general skill and proficiency of our Officers left nothing to be desired—for who would wish to improve on Howe, St. Vincent, Nelson, and the rest of those who compose that imperishable roll of maritime warriors?—and it is equally admitted that the activity, energy, and daring, as well as the efficiency as fighting men of our seamen, have been equal to anything which could be expected from human efforts. On the other hand, we are now drifting—for it cannot be admitted that we are already committed to such a policy—drifting, I say, towards a system, of the results of which it is impossible to say that they will meet our needs; whilst it is quite certain that the seamen produced must be essentially different from those of the past. Up to within the last few years—until the neglect of sail power owing to the introduction of heavy ironclad ships—the training of our seamen was quite satisfactory; the evidence of this being the way in which they performed their work. The peculiar qualities of the man-of-war's man, his activity, his intelligence, his general handiness, are not accidental circumstances; if effect can be traced from cause, it seems certain that these qualities are not due to the breathing of sea air or to anything analogous, but to the conditions of life with which he has been trained up. It is evident that the circumstances in our new fighting ships are wholly dissimilar from those of ships moving under sail; and the position consequently presented is that, either the new conditions are equal to the old ones for the production of quick and active men, or they are not so. If they are not so we must, in accepting them, be content to see the Navy manned in future by men whom we admit to be inferior to those who have gone before. Such a reduction in efficiency will certainly not be readily assented to by the Service. This view of the question

appears to require but slight consideration; those who would accept a personnel inferior to that which has made the British Navy renowned, could only justify it by some overwhelming reason, such as there being practical difficulties amounting to impossibility in the way of the superior training. No such impossibility has yet been shown, and I must leave the demonstration of it to those who are satisfied to drift on in our present downward course.

On the other hand, are, then, the conditions of life in our new ships really calculated to produce fighting men for service afloat (we need not use the word seamen) as good as those of our best fighting days? There is absolutely no proof of this, nor, indeed, any satisfactory evidence to point towards it; and it must be difficult to avoid the conviction that those who are satisfied to try experiments in such matters, and who urge on the adoption of them by those in authority, are lightly incurring a grave responsibility towards themselves and towards the country.

The position taken up by the advocates of a proper use of masts and sails—those who hold that a serious loss would be incurred by the abandonment of a sailor's training for men of the Navy—is that there is no such training (practically to be met with) for the stimulation of courage, enterprise, coolness, quickness of eye, and readiness of movement, as that entailed by life in a ship moving under sail. I would ask you to mark the distinction between sail drill or drill aloft, and the work of a ship moving under sail. The drill alone has its advantages; it gives gymnastic exercises, and no doubt goes a long way in strengthening the powers of quickness of eye and movement; but it is a very different thing from the conducting of a ship at sea by sail power. Those who support an abandonment of the old system of training have before them the task of producing men of qualities as high as those of the seamen of former days. How do they intend this to be done? Apparently by nothing more important than the ordinary work of a mastless man-of-war in peace. It is difficult to see how any striking result, any raising of the men above the average training of certain other public bodies, can be attained in this way.

Whilst preparing this paper, I have had the advantage of studying a very able paper by an Officer of the United States Navy, who has had great experience in the training of seamen—Admiral Stephen B. Luce. He puts so clearly the question of the life of a seaman in a modern man-of-war, as compared with the old training, that I cannot do better than quote from him. The Admiral dwells first on the elevation of mind, or superior tone imparted to it, by the conquest of the fear of death. This conquest is most readily attained by the life of a fighting man in war; on closer approach, dangers are found to be less than at first they appeared to be.

“During long years of peace the life of a soldier is one of comparative inactivity, and unattended by those dangers that try men's souls. It is not so with the sailor. . . . The whole life of a seaman in a sailing vessel may be said to be passed in confronting danger. The constant contending with winds and seas develops those

rare qualities in the sailor, the exercise of which is demanded in a like degree by no other calling. Of this familiarity with danger comes a contempt for it," as in the case of the soldier enured to war. "Hence, that quality of reckless daring so characteristic of the sailor—a quality of inestimable value in war.

"Formerly, the best and most thorough school of training for young seamen was on board the merchant sailing ship. . . . This was due to the smaller crew of a merchant ship as compared to a ship of war, and, as a consequence, the greater and more constant demand for personal exertion; to the more economical fitting of rigging, sails, and spars, which increased the chances of casualties; and to the urgent necessity for making quick passages in the interests of the owners, which required the carrying on of sail.

"A youngster's first tussle with a royal in a fresh breeze will long live in the memory of the man. He has no time to feel dizzy or seasick, nor does it matter whether he hangs on by his teeth or toes. He must, unaided, roll up that royal and pass the sea-gasket, and do it, too, in a reasonable time, or somebody would know the reason why. From that he goes to wrestle with an obdurate topgallant sail in a stiffish blow, to stowing a jib blowing hard, to taking in a close reef. The wonder often is that he can do any work at all aloft under such circumstances; that he has any mind or strength beyond that which is absolutely necessary to self-preservation.

"No one can deny that what may be called the school of the topman on board a man-of-war is, or, at least, at one time was, one of the most difficult and perilous that could be undertaken by men in time of peace. Seafaring people whose duties rarely, if ever, carry them above the vessel's rail, are often appalled by the dangers of the sea. What then shall be said of those whose habitual duty is high up?"¹ The Admiral then goes on to point out that there is a considerable element of danger even in drills aloft in harbour; how much more so then at sea? But notwithstanding all this the seaman is cool and self-possessed in the midst of these imminent dangers, and the safety of sails, spars, &c., is insured by his courage and endurance.

Now in the present day we, who have been accustomed to all this during the whole of our service, think nothing of it; but we have to conceive in our minds the feelings of men of a different training and experience; and to ask ourselves how dangers will present themselves to those who have never passed through a school of danger.

I again quote Admiral Luce: "It is impossible for any young man to go through the school of the topman and become an able seaman, referring always to the sailing ship, without having his moral being permanently affected by it. Indeed it is well known that such experience does affect character, and has endowed the sailor with those high qualities of self-reliance, endurance, courage, and patience under difficulties, which have always characterized him."

The Admiral then cites "The Physiology of Bodily Exercise," by Dr. Fernand Lagrange: "Physical courage is manifestly increased by the practice of muscular exercises. It is almost exclusively in

¹ "Naval Training," Admiral Luce, p. 369, &c.

men whose daily work is laborious, or who are given to violent exercises, that we see bold and energetic actions. . . . In difficult exercises"—and what exercise more *continuously* difficult than the working of a sailing ship?—"In difficult exercises, all the psychical faculties associate in the work of the muscles; hence arise the most characteristic conditions of difficult exercises; they need brain work. Judgment, memory, comparison, will, such are the psychical factors which preside over their performance."¹

Hard and continuous labour is, no doubt, the rule of life of the working man, but certainly not hard exertion of both the physical and mental powers at the same time. It is this which gives the great importance to the working of a ship under sail.

Dr. Lagrange, in another passage in his book, explains that exercises with the legs are superior to those of the arms. He says that increase of breadth of chest (chest measurement is the most difficult point in entering boys for the Navy) must be sought in exercises which make a great demand on the lungs, and that it is not proper to trust to the muscles of the arms to expand the chest. Also that the legs before becoming fatigued can perform thrice the quantity of work which the arms are capable of.² "The legs can perform much work without fatigue, because they possess powerful muscular masses. No exercise can produce for a very short time a sum of work comparable to that performed by a man who goes quickly up a staircase, or runs up a steep slope."³ The learned doctor would certainly not have stopped short here if he had ever had to run up a topmast rigging. How inferior, then, as a mere question of physical development and exercise, gymnastics are when compared with exercise aloft!

From his previous reasoning Dr. Lagrange draws the conclusion that exercises of the legs are generally to be preferred to those of the arms when it is desired to develop the chest.⁴

The especial exercise of going aloft has gone with the masts, that of hauling on ropes has also been extremely minimized, and severe work in pulling in boats has similarly been lessened, till vanishing point as far as severe labour is concerned is almost in view. What then is offered in exchange for this? Gymnastics and nothing else, unless we are to include boat sailing. Gymnastics are excellent in their way; but, besides what has been already said of them, it is to be observed that in two points at least, they are quite unequal to the act of working a sailing ship; first, they give after a certain time but little exercise for the mind; second, they produce no evident and immediate useful effect, and being therefore not a necessary part of the daily life, but an inconvenient excrescence, so to say, they must end by becoming distasteful to the men if employed to the full extent necessary for the men's physical development.

¹ "Naval Training," Admiral Luce, p. 373; "Physiology of Bodily Exercise," Lagrange, p. 379.

² "Physiology of Bodily Exercise," pp. 304, 305, &c.

³ *Ibid.*, p. 276.

⁴ *Ibid.*

I believe that in this principle lies the odium which has come to attach itself, in the feelings of many, to the use of masts and sails. Our largest ironclad ships were for many years heavily rigged, with masts and sails which were practically useless for propelling the ship; and they were never trusted except in most favourable circumstances. Sail was frequently made at sea, not to propel the ship, but as a matter of exercise or routine, and was duly taken in again when the clock indicated the proper time. The masts were evidently employed for purposes of drill, and for nothing else; they were not respected as being useful, and therefore most naturally fell into contempt; whilst the important advantages underlying their employment were not observed. No fine weather functions of masts and sails unconnected with any idea of the propulsion of the ship, can continue to be interesting, and therefore useful in the training of the mind. It is this aspect of the question that it is especially desirable to press upon the notice of the profession. On the other hand, when an intrinsic interest resides in the masts and sails, when the management of them is essential to the progress of the ship, sail and spar drill become of solid utility; by the ever present sense of danger involved in their use they cannot fail to overcome the frequent apprehension of danger which is so generally experienced by those leading quiet lives.

In another passage in his book Dr. Lagrange gives a most interesting discussion of the fact discovered by Helmholtz in 1850, that a muscle never obeys instantaneously the will which commands a movement. The passage is a little too much in detail to quote here *verbatim*, but it may be summarized as follows:—"The retardation is in part due to the time taken by the stimulus in travelling along the nerve, but taking into account the duration of this passage, which can easily be measured" (there is an instrument for the purpose on board the "Vernon") "it is found that there is still an appreciable period of time, during which the muscle which has already been stimulated has not yet begun to contract." This period or interval of time is called the *latent period*. Different conditions may cause variations in the length of the latent period, and make the obedience of the muscles to the stimulus more prompt or the reverse. The most efficient condition for shortening the latent period is the intensification of the stimulus received by the muscle. When the muscle is stimulated by the will the same law will be applicable to the duration of the *latent period*, and this will be shorter in proportion as the order of the will is accompanied by a stronger stimulation of the muscular fibre.¹ In fact quickness of motion depends on energy of the will.

We scarcely need a scientific doctor to teach us that, it is self-evident when we think of it; but we do require to have the fact brought before us in order fully to grasp its importance.

The will orders, and the order having been transmitted through a complicated chain of nerves, &c., the muscles execute.² The will is developed and improved by the repeated use made of it. The person

¹ "Physiology of Bodily Exercise," Dr. Lagrange, pp. 250 and 361.

² *Ibid.*, p. 353.

who, every day, in spite of the different pains of fatigue, sustains energetic and prolonged muscular efforts, acquires a greater power of *Will*ing; and from this acquisition result certain very striking changes in his moral disposition. The habituation to work gives to a man greater energy of will, considered as a motor force; and from this change, of a moral order, as much as from that of a material order, results a particular form of courage, which we may call physical courage.³

Indeed, there are few powers of mind and body which are not strengthened by practice. Work aloft in a man-of-war most certainly stimulates quickness of action following on the reception of a mental impression; the seaman's life will then often depend on the quickness with which he does the right thing. Instances of this will be present to the minds of most seafaring persons. In modern fighting ships this instinct will not be called much into request above the gunwale, but the ready obedience of the hand to the intimation given by the eye will remain a most important quality in gunnery. If when the eye observes that the sights are on and gives notice accordingly to the brain, the nerves are sluggish in conveying to the arm the order to fire, the shot will be thrown away. It is true that in this particular there are men to be found whose natural quickness is very great, but in men-of-war's men the end to be striven after is not to select a number of men, each possessing some special natural gift, but so to train the whole as to bring out the powers that are latent, as well as to strengthen those which are developed.

If coolness was ever of importance in fighting it is indeed so now, when a little flurry on the part of the captain of the gun may lead to a premature discharge, and the consequent throwing away of perhaps one-fifth of the ship's broadside. Now, complete coolness is not exclusively a natural gift, any more than flurry is exclusively a natural defect; the former may be improved by good mental discipline, the latter may be aggravated by a neglect of self-command. Coolness depends on an absence, or stifling, of apprehension; apprehension is a dread of possible consequences; a dread of consequences is banished by familiarity with the immediate surroundings; and the mind is strengthened against nervous fears, misgivings, or doubt, by the habit of facing dangers, the avoidance of which depends on the person himself.

In dealing with a subject so important as this of the future bringing up of our seamen, I must risk a charge of arrogance and express the opinion that whilst there are employments to which our men are not suited, and in which, therefore, they are excelled by others, the seamen of the Navy surpass every other body of men in activity, quickness, and general intelligence. We are of the same flesh and blood as the rest of our countrymen, and yet to my thinking there is no other class which comes up to them; those nearest being the Marines. An answer may be given by the opponents of masts and sails that any superiority there may be is due to the habits of discipline instilled into Officers and men whilst young, to the emergencies of a sea life, and so forth; in fact, the effect will be assigned to causes

³ "Physiology of Bodily Exercise," Dr. Lagrange, p. 208.

which may possibly have some influence, but which could not sufficiently account for the pre-eminence of the qualities observed. It is extremely difficult to bring forward any simple evidence that under a neglect of the old system, it will not be possible to produce seamen as good as those furnished up to recent times. This subject not having been a matter of study, there are no prepared data for the support of the theory, but, nevertheless, we are not entirely without the means of showing that in times past our seamen have performed deeds which no other of their contemporaries succeeded in effecting; and the consideration of this fact must lead to the conclusion we desire to reach. For some military operations on land, seamen are not so well qualified as soldiers; for others they are not by their training fitted; but the prominent position occupied by the seamen in joint expeditions of the Navy and Army, established the contrast which must exist between men who have had their energies quickened under the influence of the life of a sailing ship, and those who have not. It is no disparagement to others to say that, in quickness and activity of body, in fertility of resource, and in the power of finding means to overcome difficulties, the seamen are superior to any other body of men. The sailor is a better all-round man than his soldier colleague. Why is this? for the creature is the same, the Officers and men of the Army are drawn from the same classes as those of the Navy. It is the result of education; the sailor has as much advantage over the soldier as the man educated at a public school has over the boy brought up with the best instruction but amongst a much smaller number of companions. Now, wherein is the life in our mastless ships going to differ in its influence from that in the Army?

It is almost superfluous to enter on any description of the peculiar qualities or attainments which make a seaman the useful man he is generally allowed to be; the existence of such qualities is admitted by every nation, and it is not easy to see what cause can have produced them except the peculiar conditions of life in ships which move under sail. In attempting to show exemplifications of the valuable characteristics of the sailor from records of the past, we are met at the outset by the difficulty that the general acknowledgment of the usefulness of the sailors was so complete, that, as a rule, a detailed record has not been thought necessary; a bare notation that valuable aid was rendered by the seamen on shore is generally all we find in accounts of joint expeditions, though it is known how essential their services were to the success of such undertakings. Writing has preserved to us, however, details of some exploits which are worth repeating here, as showing the ability of seamen to perform acts which were virtually impossible for others.

In the combined attack on Martinique under General Monckton and Rear-Admiral Rodney, resulting in its surrender in February, 1762, the seamen brought cannon upwards of three miles through what might seem impassable difficulties, and drew the heaviest guns and mortars up the steepest mountains across the enemy's line of fire, and this with so much coolness and intrepidity that on the first cannon sent up the heights a sailor was seen sitting across it playing "God

save the King."¹ I venture to think that that sailor's conduct was as good to the combined forces as a strong reinforcement of men.

In the combined attack on Negapatam, in October, 1781, under Sir Edward Hughes and Sir Hector Monro, we are told that the difficulties of landing the artillery supplied by the squadron, were surmounted with incredible labour and fatigue, and no small danger, by the courage and activity of the seamen; and later, that in a brisk action the seamen and marines left little to be done by the land forces nothing could withstand their attack.²

I may here mention an amusing incident of Admiral Vernon's capture of Porto Bello, on the 20th November, 1739. This expedition could scarcely be considered as a joint one, for only 200 soldiers under Captain Newton were acting with the Navy, and the seamen, therefore, had it pretty much their own way. "The Admiral made the signal to land, and though there was no practicable breach, the fort was carried by assault. As a substitute for scaling ladders the sailors mounted on one another's shoulders; thus they became masters of the fort, and drew up the soldiers."³

At the taking of Martinique, however, in 1794, by Vice-Admiral Sir John Jervis and Lieutenant-General Sir Charles Grey, the deeds of the seamen were of surpassing importance. A party of about 300 seamen, with a small number of Marines, was landed under the command of Captain Eliab Harvey. "This detachment having in charge a 24-pr. gun and two mortars, began its march towards the heights of Sourrière, a distance of 5 miles. After cutting a road nearly a mile in length, through most difficult country, this persevering party, before the night of the third day, to the astonishment of the whole Army, got the 24-pr. on the heights and the two mortars to the foot of the hill, from which the summit was about a mile distant. On the following day the howitzers and two additional 24-prs. were got to their places on the top of the hill, and this, although the ascent was so steep that a loaded mule could not walk up in a direct manner."⁴

"There is authority for saying, that the efforts which, though not in their own element, those indefatigable seamen made, quite astonished the Army."⁵

Tradition says that on one of these occasions a gun was raised to an otherwise impossible point, by being made up in a cask and then parbuckled. Whether this is a fact or not does not touch the principle, which is that those men were determined to succeed, and to invent means somehow; and that the power of doing so came from their seamanlike training.

Early in 1804 the Diamond Rock, near Martinique, was taken possession of by Commodore Hood in the "Centaur." The way in

¹ "Beatson's Naval and Military Memoirs," vol. ii, p. 522, &c.

² "Annual Register," vol. xxv, p. 91.

³ "Naval Chronicle," vol. i, p. 174; Beatson's "Naval and Military Memoirs," vol. i, p. 50.

⁴ James' "Naval History," vol. i, p. 241.

⁵ Tucker's "Life of Earl St. Vincent," vol. i, p. 113.

which guns were raised to its seemingly inaccessible heights by means of a hawser from the masthead of the "Centaur" is well known. An eye-witness, a visitor, alludes to it as follows:—"Were you to see how, along a dire, and I had almost said, a perpendicular acclivity, the sailors are hanging in clusters, hauling up a 24-pr. by hawsers, you would wonder; they appear like mice hauling a sausage."

"Believe me, I shall never more take off my hat for anything less than a British seaman. It is easy to subscribe a million of money at Lloyd's . . . but it requires the hearts of lions, and the fortitude of untameable spirits to attack the bold front of defiance-bidding Nature."

Again, in the war of the Crimea, there was full evidence that our seamen were still what they were in earlier times. Speaking of the embarkation of the Army at Varna, Mr. Kinglake says,¹ "Lord Raglan could not repress the feeling with which he looked upon the exertions of our naval Officers and seamen. 'The embarkation,' he wrote, on the 29th of August—'the embarkation is proceeding rapidly and successfully, thanks to the able arrangements of Rear-Admiral Sir Edmund Lyons and the unceasing exertions of the Officers and men under his orders. It is impossible for me to express, in adequate terms, my sense of the value of the assistance the Army under my command derives from the Royal Navy. The same feeling prevails from the highest to the lowest—from Vice-Admiral Dundas to the youngest sailor: an ardent desire to co-operate, by every possible means, is manifest throughout; and I am proud of being associated with men who are animated by such a spirit, and who are so entirely devoted to the service of their country.'" Again, speaking of the landing of the Army near Lake Kamishlu, beginning on the 14th September, Kinglake says,² "The landing went merrily on. It might be computed that, if every man in the Navy had only performed his strict duty, the landing would have taken some weeks. It was the supererogation, the zeal, the abounding zeal, which seemed to achieve the work. No sailor seemed to work like a man who was merely obeying—no Officer stood looking on as if he were merely commanding, and though all was concert and discipline, yet every man was labouring with the whole strength of his own separate will." And so he goes on to speak of the "good humour shown, and how the sailors carried the soldiers ashore to keep their feet dry."

To all these citations I will add but one more, viz., the expression of opinion by General Sir William Jervois, in an article published in the "Nineteenth Century," of January last:—"My experience of Officers of the Royal Navy is, that the proportion of inefficient among them is beyond comparison smaller than in the Army."³

Again I ask, to what is all this due if not to the peculiar conditions of training of the Navy? And yet it is proposed to make a radical and complete change in those conditions.

¹ "Naval Chronicle," vol. xii, p. 206.

² Vol. ii, p. 139.

³ P. 180.

⁴ "Home Rule for the Navy."

Let us now examine a little more closely the reasoning of those who desire to abolish entirely the old training of seamen. There are, naturally, diversities of opinion in detail; but the main contentions, as I understand them, are that masts and sails are no longer required to propel ships, and having, therefore, lost their *raison d'être*, they ought not to be maintained in any form, and that attention should be turned to other ways of employing the men; 2ndly, that the whole time of our men ought to be occupied in learning the use of weapons great and small. To this I will briefly reply, 1st, that it is as easy and as economical as ever to propel ships under sail; that in certain cases the peace occupations of the Navy can be performed as well under sail as under steam; and that in other cases sail *must* be used, or the work left undone. To the second contention I reply, that it is of less importance to have the men very highly trained to arms than it is to have them with hardy minds and active bodies; and that vigour of mind is produced by training, as is the case with vigour of body. This sort of training of the mind is the greatest advantage I believe to result from an intelligent use of sailing ships. The argument which would abolish such training for our men condemns the encouragement of our hunting fields and horse races, it condemns the encouragement of cricket and gymnastics, they are all alike unproductive of any direct increase of knowledge.

Hitherto the opponents of masts and sails have assumed their case, and to a great extent drowned opposition by repeated assertions of the uselessness of the old kind of training; but they have really shown no sound cause for their contention: and surely the burden of proof rests on them. The efficiency of the old system is an axiom; the evils of it are not shown; the future results of a change to a new system have not been proved to be satisfactory. In fact, it is a leap in the dark which is proposed to us. Those who advocate a continuance of training of the old sort are on sure ground; who can tell the result of a change? certainly no one can say our seamen will be better. Who would not rather go into action with bold and dashing men than with those more acutely trained in all the warlike movements, but of a softer moral fibre? I say, standing on the past, we are on firm ground; but is not that simply a will-o'-the-wisp which is pointed out to us in the mist of the future?

The veteran French Admiral, Jurien de la Gravière, writing in 1880, and speaking of the necessity of keeping seamen at sea, says:—"The fleet which is the fittest to brave the tempest, which will best face difficult navigation and stormy nights, will be, whatever its numerical strength, the first fleet in the world." He goes on: "Let us encourage daring, awake a spirit of enterprise—let us strengthen the weak-hearted." And he adds that he asks for a fleet manned by sailors, and not only by gunners and soldiers.¹

It is to be remembered that amongst the naval authorities already cited are, or were, not Officers of retrograde tendencies but, men in the highest esteem in their own country or in other countries, by Officers of all shades of opinion.

¹ "La Marine des Anciens," vol. ii, p. 173, *et seq.*

It is wholly misleading to argue that to get the most satisfactory results in the education of a man you must put him, in the first instance, to the class of work which he is ultimately to perform; that is a notion quite unworthy of a reasoning mode of developing the human intellect, and is certainly quite opposed to modern ideas in general. The mind and body should first be brought to a proper condition in which to receive the special instruction; the rejection of work in sailing ships is the rejection of preliminary or fundamental instruction—the instruction which will give that quickness of body which will show itself in all future undertakings. Besides the ordinary disadvantage of premature instruction there is with regard to the Navy, a consideration which is deserving of notice; namely, that the mind of average persons will not continue to grasp and retain constant changes of details. The conditions of our Navy are wholly dissimilar from those of the navies of foreign countries, in which the bulk of the men perform a very short period of service—into which period, of course, all their instruction must be compressed. We look to keeping our men for upwards of twenty years, and it is worth considering whether a full mastery of details which will change, should be pressed on them at the outset of their service. Few do not know the disadvantage of having the mind filled with obsolete minutiae, which impede the ready reception of newer and more important matters; and it is to be observed that the full time of our men being completed at about the comparatively early age of 40, they are in the full vigour of their powers of learning for many years after their first entry.

The entire abolition of masts and sails would entail on the seamen a loss of a special knowledge which, indirectly, is very important in modern naval warfare: that is, a facility in handling ropes and tackles, and in much of what comes under the head of knotting and splicing. This power contributes greatly to the readiness with which a sailor meets difficulties in handling weights. I do not say that they could not go through a course of instruction in such matters, but they would not be ready with them. Few seamen can have seen the torpedo booms and nets of large ships handled without a feeling of how much their difficulties would be increased were the men not ready to bring the power of tackles to bear at any point without awkwardness or hesitation; and this power means knotting, splicing, seizing, knowledge of strength of ropes, mode of protecting ropes, &c. All this is second nature where sails have to be handled.

Let us now inquire to what extent the life in a mastless ironclad tends to prepare the mind or body. I may summarize some remarks of Admiral Luce on this point. By the multiplication of steam machines much bodily labour is saved to the seaman, no constancy and skill are now required to trim the sails at every change of wind. What exemption from labour and peril! In the heaviest gale at sea he may now repose, leaving all the work to the steam party. Formerly, when a vessel got under way, the whole crew were required. It was an operation that often called for the exercise of great skill on the part of the Officers, and for the utmost attention and readiness on the

part of the men. Now, with the exception of getting up and stowing the anchor, which usually calls for no special skill, and often for little exertion on the part of the crew, half a dozen men on deck may take our largest ships to sea.

In this case alone, is there no loss of mental and moral effect on the crew consequent on the change?

Not long ago in this room, Admiral Colomb in the course of a discussion said, that the cause of the British seaman being the smart man he is in the present day is not the masts and sails, but the custom of doing everything against time. The Admiral then went on to suggest that if necessary for producing the same effect in the future, sailing ships should be employed in certain services. This seems really to sum up the situation; this is what is wanted; and whilst we still have masted ships suitable for flying squadrons, there is no necessity to build special vessels. But let there be no more make-believe with the masts: let everyone see that they are really for use, and then they will be as much respected by the crews in those vessels, as in any other vessels depending on sails.

More than four and a half years ago, after a considerable interval, a new detached squadron was formed—the present Training Squadron. Its dimensions are small compared with those of its predecessors, and the length and limits of its cruises have been much less than theirs. Probably better work might be got out of the Training Squadron by some additions to the present system; but, nevertheless, no one well acquainted with the work performed, and with the Officers and men, can fail to recognize the important influence produced in brightening the intelligence of the whole personnel. It is impossible to speak too highly of the effect of the Training Squadron. I can testify to the value I myself derived from it, and I keenly feel how much would have been lost by me had the same period been spent with steam alone as a motive power. There is no comparison to be made between the work of handling the ships of the squadron under sail and the steaming along of ironclad fleets with sails untrimmed and a mere make-believe; any attempt at comparison is entirely to mistake the nature of the work and the effect produced.

From remarks which may be gathered, and for other reasons, there is good ground for considering that those Officers who have not been specially engaged in the bringing up of boys and young men in large numbers—that is of preparing our raw material—do not enter so fully into the advantage of special preparation (before entering on the more important work of a seaman's profession), as those who have been so engaged. The change produced in the Officers of the Training Squadron, in their manner of carrying out their duty, was very marked. I know I am not obtruding my own opinion alone; I cannot presume to speak for others, but I know what is the opinion of those who have been most closely connected with the squadron; and I confidently look forward in a few years' time, when the little rubs of a somewhat arduous service are forgotten, to the views I have put forward on this question receiving the strongest support from those who have themselves been Officers in the squadron. There is

in it, no doubt, a great loss of personal comfort as compared with newer vessels, and vessels spending less time at sea; each ship carries as many Officers and men as she can possibly contain, and the accommodation is therefore very restricted. All this must weigh heavily against that particular service, but with regard to the actual duty there is no reason to believe that it is unpopular, and there seems to be no ground for assuming that a feeling of disgust at, or contempt for, the sails has any existence in the minds of the Officers or crews. It is more than probable that a better acquaintance with the work of the squadron and the effects of that work would modify the views of many of its opponents.

The ships are easily controlled under sail and do what is required of them; the masts and sails, therefore, have established their *raison d'être*. Entering and leaving harbours under sail exercises in a most valuable way the powers of judgment of the Captains; keeping station and the handling of sails in different circumstances of weather, exercise continually the judgment of the Officers of the watches.

What is offered in exchange for this? Gymnastics and boat sailing. Is it supposed that gymnastics—entirely unproductive labour—will not become odious when their novelty has worn off? Are not gunnery drills so when continued after the subject is learnt And for boat sailing, is not that carrying out in a small degree exactly what is condemned on a larger scale? Have not different Officers for long past continued to inculcate boat sailing, and is it not still neglected to a great extent? Is there any chance of the sailing boat resuming the important place it used once to occupy in the formation of the character of young Officers; are not the young Officers almost always at school, or working steam launches? When midshipmen with their crews had to take their boats in from Spithead or Plymouth Sound, blowing half a gale, the young Officer had real work and responsibility thrown on him; on him rested the care of valuable stores and of the lives of Officers and men. Is it likely this sort of thing will be restored? Certainly not in a fleet from which seamen are to be excluded.

In the handling of a ship under sail there is an important point to which too much attention cannot be drawn; it is the practice which the Officers gain in the handling of their men. An Officer of the watch has constantly to study to adapt the means at his disposal to the required ends; to consider how the work can be done with the least disturbance of the men, either from their rest at night, or from their drills and other work during the day. The accomplishment of this is a great exercise in foresight, as well as of executive ability at the moment. In working a ship under sail, the manner in which Officers and men come in contact is resembled by nothing else except general quarters and divisional gun drills; and the amount of these is not greater in mastless ships than in masted ones. The Officer thereby learns to control his men and the discipline of the men is improved by being commanded by their Officers.

It is not, perhaps, fair to hold anyone to opinions formed some years back on naval subjects, but it should be observed that opinions have in some cases changed very much.

Bearing this in mind, what security have we that those who have changed so much have yet reached their resting place? When the old system has been completely upset, who can say that the system which takes its place will not quickly follow? The form of the arguments against the old system keep on changing, first one modification is advocated then another. Opinion seems to be in a state of flux, shall we not do well to pause till it has assumed a more stable condition?

The experience on which the newest class of opinion is formed is very short; it is now little over two years since the first squadron, composed of mastless ships alone, came into existence; the dissatisfaction at sails used as instruments of exercise and nothing more, is not yet softened down by time, we have not yet got men brought up under a new system. Time does not press, in any case there is no necessity to come to an instant, perhaps a fatal, conclusion as to making changes; we have plenty of ships which will go under sail alone; does not reason, then, point to the undesirability of taking a hasty and perhaps irretrievable step?

But if masts and sails are to be absolutely and for ever abolished in the Navy, there is another step to be taken of which we have as yet heard nothing. In such case, the present work of our boys' training ships becomes more than objectionable. Can any possible argument be adduced for giving newly entered boys careful instruction in matters which they may afterwards see at a distance but will never come in contact with? Will the bending and making plain sail, the trimming sails, the spar drill all be continued? Can there then be any reason in sending the boys to sea in small vessels which will have absolutely no connection with their future life? Evidently the argument which abolishes the old seamanship for the younger men-of-war's men equally abolishes it for the boys; for it is to be remembered that the boys have little or no intelligent idea of the end and object of all the seamanlike exercises they go through, the utility of them lies in their being a foundation for the actual work of a ship under sail.

From all that has been now said, a question will naturally arise as to what steps we should take to keep the personnel of our Navy up to its present high standard. Fighting ships of new classes being exclusively mastless, the greater portion of the seamen will necessarily be employed in such vessels. We still have, however, a number of sound and strong men-of-war capable of being propelled by sail power alone, and sufficient to receive on board a large body of seamen. Not only does there seem no doubt as to the possibility of usefully employing these vessels, but we are aware, from a reply of the First Lord of the Admiralty, that, for the first time on record, the want of power of mobility—the inability to carry sufficient coal—has hindered the sending a man-of-war to a distant point to perform one of the great duties of the Navy in time of peace, the rendering of

aid to distressed persons of the mercantile marine. A sailing man-of-war would have performed the service as quite an ordinary piece of work. There are still parts of the world the visiting of which by steamers alone, presents grave difficulties. In addition to this, there are services connected with the conveyance of stores—stores as to which there is no hurry, of which the conveyance is a matter of routine—of the conveyance of men, &c., as Admiral Colomb has remarked, which might well be performed by ships manned from the Navy. In the French Navy a similar custom prevailed, and Admiral Jurien de la Gravière¹ has observed that Cochin China and New Caledonia have rendered to France the greatest service for which they will probably ever be called on, in employing at sea a considerable number of French men-of-war's men in conveying stores to them.

It has, amongst some Officers, been a fashion in past years—before the days of mastless ironclads—to decry the sailing qualities of many of our screw ships; this ship was too long, that one was too broad, the rest had insufficient keel or drew too little water, and it was no use trying to make them sail; but in squadrons the difficulties usually disappeared. We have only to compare the records of performances of ships in old days with those of recent times—passing over the best days of the experimental squadrons—to see that our ships are quite as manageable, in many respects, as the old ones, and make much better passages. Though the newer vessels may not work so quickly as they are wanted to do, they seldom fail in other respects. One of the latest models of masted ships, the “Calypso,” is a remarkably fine sailing vessel, and her sister ship, the “Calliope,” is probably similar.

The system, then, to adopt for training our seamen up to the point of their becoming the best description of gunners, would be to enter and train them as boys, in much the same way as at present; then to pass them on to vessels capable of moving under sail, and to employ them in such work for as many of the earlier years of their time as the general arrangements of the Service would admit of.

There does not appear to be two opinions on the advantage to the Service of a detached squadron free from the duties of a station, and which goes long voyages and to many places; our former flying squadrons have sometimes been irksome, but never uninstructional.

Independently of the actual occupation and training of the men, a sailing squadron has superior recommendations as compared with one of steaming ships, and it is indeed to be hoped that the principle involved in their employment will be maintained. There is good work to be done in masted ships singly, but squadrons are far better; the masted ships should therefore, as far as possible, be collected in squadrons.

I submit that we require more than one flying squadron, and that the number of men employed in masted ships should not be less than 4,000. If it were desired to have the men home annually for the summer manœuvres, the most suitable plan would appear to be to have one cruise each year, lasting from early autumn to late spring, the summer interval being just sufficient to cover the necessary

¹ “*Marine des Anciens*,” vol. ii, p. 173.

refitting and the manœuvres. If desired, the crews of the masted ships might then be transferred completely to mastless vessels for the manœuvres, their own ships being temporarily laid up.

The active and energetic spirit which characterizes the Navy is so complete a part of it that there seems to be an inseparable connection between them; this spirit has been, so to say, built up by successive events and peculiar surroundings; what security, what reasonable confidence is there that it will be maintained in completely altered conditions of existence? A falling off might not be immediately visible; it might be years before the man-of-war's man could be pronounced quite different from what he is now, but, unless human nature changes, the alteration would be certain. For years past we have been living in a war scare, and this has given an immense impetus to the study of war and its weapons; but a reaction must come. The much talked of general disarming of Europe may reasonably be expected, and then our present new weapons will become obsolete, and there will be less respect for these implements, which are seen to be constantly changing. The only unchanging part will be human nature, and, whatever alteration there may be in weapons, we have to take care that our men shall then be found equal to what they were in the past. To ensure this, we have to employ our men, especially for the first years of their service, in a healthful, active, and useful way—until habits of smartness are formed—and to give our young Officers occupation calling forth a continual exercise of the most active powers of their minds. Unless this is done, the professional standard must fall.

Any form of competition which can be practised in mastless ships is very much to be encouraged. The importance of constant practice in handling mines, torpedo nets, anchors, &c.—and this against time, wherever possible—cannot but be fully recognized. Such exercises may possibly suffice to maintain the smartness of men who have already acquired that quality, but there is nothing to encourage the hope that its original acquisition in mastless ships is possible. No harm will be done if, for the younger men, the practice of most of these evolutions is reserved until the course of the Service carries them into mastless ships.

There is a general tendency for men, who are not themselves old, to consider that the spirit of progress and judgment resides in their generation alone; the mistake is frequently not perceived till too late. The Officers who for years past have placed themselves in the fore-front of naval progress have been amongst those highest on the list. The modern high discipline of the Navy was initiated by a Commander-in-Chief in the Mediterranean. Through whose exertions was that singular but successful ship, the "Polyphemus," added to the Navy? To whose persistent efforts is the recent addition to the number of ships mainly due? In what grade do we find the Officer who has the highest repute as a naval tactician? And is the opinion of any such thinkers to be hastily pushed aside with the cry of impossibility? England cannot afford to dispense lightly with the traditions of the past, nor to change completely, on the hasty decision of some of her naval Officers, the system which has brought the

Officers and men of the Navy to the present high point of efficiency, and this, too, as an untried experiment. The recollection of Trafalgar is a tower of strength, and its memory is that of daring and skilful seamen; can it be wise to reject the qualities which gave such great results, and to resign the characteristics which have always been the support of our country?

The necessities of our position render it imperative on England to maintain a Navy superior to those of foreign countries, and to take care that in no matter, not even of detail, shall they gain a pre-eminence; but it is no part of our business to force on changes in the implements of war, such advances are, as a rule, especially to the disadvantage of this country. Many of the modern appliances of war distinctly favour the weaker Powers, and, so far, are a loss to ourselves. Our main point is to keep up the standard of efficiency of our men; it was by our men, not by our materials, that the great victories of the past were gained, and whilst we cannot overlook the materials, our dependence must be principally on personal qualities. Again, then, let us pause before reducing ourselves to the level of others, and thereby renouncing the great advantages enjoyed in the past.

Should, however, the bringing up of our Officers and men be revolutionized in the manner advocated, will it in years hence be still possible to say that the Navy contains a far smaller proportion of inefficient than other Services?

Captain CURTIS: I think that perhaps the paper would have been more correctly named, if I may be excused for saying so, "Masts and Sails a means of Training and of Locomotion," because Captain Johnstone has referred to the sailing of our ships, and I think he mentioned a vessel in the Pacific that could not relieve some of our shipwrecked sailors on one of the islands for want of sail power. Formerly everything used to emanate from the Admiralty, who used to send out their orders, and so forth. I think nowadays public opinion is generally respected, and if the Admiralty were to send a circular to every Captain, Commander, and Lieutenant in the Navy, and ask their opinion on this point, they might get some valuable information. With regard to our first and second class battle ships, it is decided that they shall not have sails for the future, and I take it that Captain Johnstone wishes to keep a perpetual Training Squadron that will have at least two masts square rigged. It appears to me that the "Vigilant," and that class of gunboat—you recollect them very well in the Mediterranean in 1855-56—were perfectly capable of keeping their stations with the frigates and the men-of-war, and, from what I recollect of them, they were square-rigged forward, the same as the "Allan" boats. I asked some Officers on board the "Allan" boats why they kept the square sails forward and did away with them on the mainmast? They said that they could so do with less men, and sail quite as fast. I contend that sails are a safety to a ship, especially in a gale of wind. They give a larger freeboard, and anyone who has ever read Captain Washington's inquiry into the loss of the Scotch fishing boats in 1840, will remember that the evidence was that they sustained no loss from shipping a lee sea. Any man who has been hoisted in a very serious wind will find that with the lee ports battened in, the ship will ride over the water like a duck, with reefed balance sails, &c. With respect to the gun in a barrel, I believe it was at Valparaiso, under Admiral Dundonald, that the gun was taken up the mountain by the sailors; and I believe, with Admiral Luce, whose opinions have just been quoted, that the merchant marine and the former coal trade with the north were the best schools of training for our seamen. No less an authority than Lord Nelson is said to have stated that the northern seamen

had won the trident of the ocean. I believe Lord St. Vincent said that every man in those ships was capable of acting in an emergency as captain in handling the ship. With respect to the seamen in the Crimea: when we landed at Alma, I have heard the story related that seamen were of great use in helping to hitch the horses to the guns. At Balaclava, whilst the engineers were waiting for their triangles the sailors put the guns on the carriages and took them up to the front. The Naval Brigade made a suspension bridge over a gorge, saving a long round. In the Indian Mutiny they were again to the front with the skirmishers, dragging the field pieces. With respect to sails, I think there is a certain class of ships, I do not know whether cruisers, but certainly a certain class of gunboats and torpedo-catchers which during a state of peace, I think, should have a certain quantity of sail, and if the sail is found to be an incumbrance during war they might be dismantled. Dismantling might be performed occasionally for practice.¹

Captain H. J. MAX: As quite a young Officer amongst so many Officers of experience, I must apologize for putting my views forward; but, as Captain Johnstone has told us, this is a very important matter in the present day. We are in a position of change, and how shall we meet it? I see Admiral Colomb is present, who has taught us to appeal in these matters to history. Changes are not unknown to history. Weapons have changed both afloat and ashore. The question is, are we to go back upon the old style of fighting, and say it is impossible to train our men with the new fighting weapons in the new style? Sir, I do not think this is an impossibility. Captain Johnstone advocates, as far as I can make out, keeping something like 11,000 men and boys: that is our 7,000 boys, with whom he advocates putting 4,000 men in ships which are not, and never can be, the fighting ships of the present day or of the future. In such a case, on the breaking out of war, we should find that this large proportion, something like one-fourth of our bluejacket strength, would be quite unfamiliar with the ships they would have to fight in. We know all those wonderful records of the old wars, showing what men unfamiliar with fighting conditions did, how Pellew took a crew of Cornish miners out in the "Nympe," and fought and took the "Cleopatra"; but I do not think that is the best and the only way to get fighting men. I believe we have been charged by our country, we naval Officers, with training our men in peace time to fight, and I believe that we can do it and must do it in the fighting ships of the present day. I daresay, up to the present time, we have not done all that we could have done; perhaps we have not exercised all the resources we might have exercised. We have all seen something go wrong and have said, "Send for the armourer, send for the chief engineer." Surely that ought not to be; we ought to know our ships and everything about them; we ought not to want this from the dockyard, that from the gun wharf, everything done for us in our new ships. We ought to know them thoroughly. I think that we can do more than we do in knocking our guns about. I do not think our guns are the very delicate instruments that they are supposed to be. I have noticed on shore the artillerymen handling their guns with shears in a way that, I think, we might well imitate, and there are many other trifling things which will occur to everybody which we might do. Our men must be trained to fight the ships of the present day thoroughly, and I believe, when we have done that, we shall have little or no time to send them to sea in ships that are not fighting ships. We now have a Training Squadron, and the question comes up, is the Training Squadron a success or not? Of course it is a very difficult thing to say, but I must say, as far as my experience goes in talking to various people in connection with the Squadron, the great majority of those that I have spoken to, do not believe in it. Physically, as far as I understand, it has not been a success. I obtained the other day from a medical Officer the measurements of 101 boys of about 17 years of age, who have been four months in the Training Squadron. These measurements showed that, if anything, they had

¹ Collier seamen in jumping the coal out had an abundance of leg and arm exercise, which helped to make them powerful and agile. In making passages the merchant steamer captains are very keen in setting the fore and aft sails, it steadies the ship and economizes fuel.

deteriorated physically. We all know how difficult it is to prove these things, but it appeared that not only there were many of them stationary, but a very fair proportion had actually gone back in chest measurement, in muscular measurement, and in weight. I think these things point to the fact that our present system is not all that it should be, and I would appeal to naval men before going back, to try if we cannot turn out the splendid men that we had in the old days, in the fighting ships of the present time.

The CHAIRMAN: Perhaps Captain Acland, who was lately in command, will favour us with some observations.

Captain ACLAND: Since you call upon me, I venture to address a few words to this meeting. I had no intention of opening my mouth at all. In the first place, I think I am rather precluded from discussion, as I am on full pay, and it is not, therefore, becoming for me to discuss whether the Training Squadron, in which I have the honour of serving, is a success or not. Therefore, I can say nothing about that. For the greater part of my life I have served in masted ships. The only mastless ship that I have been in was the "Glatton," and that only for a short time; therefore my training has been in masted ships, and among sails and among ships on foreign service, and I am perfectly certain that the only way of training Officers and training men to be sailors is in the masted ships, making them work the ships under sails, working the masts and yards, and entirely depending upon masts and sails. I cannot understand, in a mastless ship, what the Officer of the watch has to do. In a masted ship, the Officer of the watch is always moving the yards and sails and working the men; but on the bridge of a mastless ship I do not know what he has to do, except turn a handle. It seems to me that he has no command of his men. In the mastless ship he misses the control of the men and the general mixing with the men: the men do not know him so well. I cannot see how they can know their Officers in mastless ships. Therefore, I think, in masted ships Officers and men are better brought together; they are better trained in their work, and they make the men better sailors. Whether we want sailors in the Navy is quite another thing. I am not quite certain whether we do, or whether what we want is stoker gunners and not sailors, but as long as we want sailors I am perfectly certain that we must train them in ships which have masts and sails. As regards the paper, I must compliment my predecessor in the "Volage" on the able manner in which he has stated his case. I have read many papers that have been given in this Institution, but I think I have read no paper in which the author has put forward his views more clearly, or brought out so well the best arguments that he can in favour of his view as to masts and sails. I should like to refer to what Captain May said about statistics as to the boys. I happen to know about those boys. The statistics were taken on a cruise leaving England in December and getting back in April. On this cruise the boys were growing boys who had come from the training ship, where they had been fed on pudding and beef two or three times a-day, but now they were put on salt meat for 80 days out of 122. For a large proportion of their time, therefore, they were living on salt meat and ship's provisions, and had to give up their duff and jam, and, I suppose, naturally they were not so fat when they came home as they were when they left England. It is perfectly true that their muscular measurements were less. I had thought that the training they would undergo, pulling ropes and running about the rigging, would naturally have made the fore arm larger and the muscles of the leg larger; but it was a fact that the measurements were, in many cases, less than when the boys left England in December. I should like to corroborate Captain May upon that point, because it is rather a point against sails. It was a cruise from England to the West Indies, and that may have had something to do with it.

Admiral Sir J. D. HAY: I wish to thank Captain Johnstone for the paper that he has put before us, and also to say a few words on this subject. Of course, my experience was with masts and sails, and I cannot for a moment venture to suggest that I can speak of the modern training of the Navy in a manner which would be of any particular value in this discussion. I am entirely of opinion with Captain Johnstone that there is no such training for the courage and skill and utility of the seaman as that given by training aloft. The gallant Officer, Captain May, gave the number of 11,000 men as those who would be supposed to be applying

themselves to a useless form of training, but, I think, in doing so, he added 7,000 boys to the 4,000 men to whom he alluded. Now, my impression is, that the boys are already trained in that manner, and that it would be very valuable if these 4,000 men, who, I think, are about one-fifth or one-seventh of the number of seamen afloat, were compelled for the first three years, and before they get their A.B. rating, to pass through the necessary drills aloft in seagoing ships. I will not attempt to criticize plans by which sailing ships are to be obtained, or the men trained in this manner, but the suggestion given from the French evidence, which goes to show that stores may be conveyed to distant stations by sailing ships when there is no pressure for time, might show the way in which a proportion of the seamen who were no longer boys, but young seamen, might be undergoing training—of course not in war-time—so getting themselves ready for the higher ratings, and for their duty on board the fighting ships in which they would eventually have to do their service. I rose principally to mention, that which, I daresay, has occurred to other Officers who have looked at the report, the statement given by a very distinguished and gallant man, Captain Eyre Massey Shaw, of the Fire Brigade. One of my duties when a member of the House of Commons, some time ago, was to sit on a Committee before which Captain Shaw gave evidence, and there fell into my hands a paper in which the former occupation of the men employed in the Fire Brigade was given, and I observed that, down to a particular period, not so long ago, they were almost entirely man-of-war's men, who had been taken from the Navy. I observed that, for the six or seven years that followed, it was not so, and I asked Captain Shaw a question upon that point. I am sorry to say the report is not here, but if gentlemen will turn up the report of the Fire Brigade Committee, and look at the evidence, they will find that I am giving the sense of Captain Shaw's answer. Captain Shaw said that the man-of-war's men had no longer that agility on the ladders and that coolness at the fires, which they used to have, and that, therefore, he had been obliged to take an inferior article from the Merchant Service, because, although he wanted seamen, he wanted seamen who had been trained aloft. That is practical evidence that, in one particular at least, there has been some little deterioration in the method of training, and I thought I might fairly mention it to this meeting, because Captain Shaw was an unprejudiced person; he had not heard Captain Johnstone's lecture. He only gave evidence as to the manner in which the service of the Fire Brigade could be best performed, and he found that man-of-war's men were not the best men for that purpose now, for the reasons that Captain Johnstone has given.

Admiral BOWDEN-SMITH: Although I was not present when Captain Johnstone's paper was read, I may state I read it through last night, and if I attempt to criticize what he says, I do so in a friendly spirit, fully appreciating the motives and respecting the opinions of every Officer who lectures before this Institution. The title of the paper is, "Masts and Sails as a Means of Training." Now, if Captain Johnstone sticks to that title, and only means by his paper that masts and sails are to be used simply as a means of enabling our young Officers and men to be trained in time of peace, I have no objection to it. But, if when he speaks of our "drifting" on in our present downward course he means that he wishes to see our fighting ships lumbered up again with masts and sails, I may say that I am very much against him. Such a proceeding would be distinctly a downward course, and a retrograde movement. It was through sticking to our masts and sails that we became possessed of a number of cruisers which could neither steam nor sail, and were of no use for modern war purposes. The lecturer does not mean, I suppose, to go back to that. I am happy to say that, owing to the agitation set up by certain Officers, we do now possess a fleet of cruisers worthy of the nation, and to put masts and sails back into any of those ships would be fatal. Captain Johnstone says again, there is nothing left for us but gymnastics and boat sailing, but I agree with Captain May that surely we can find something else in which to employ our men. There are the torpedo-defence nets, which we might make an evolution of, getting the boats out and away from the ships quickly, and other things which we might turn our minds to, to exercise the men. In any case I do not think we can afford to spoil our fighting ships with masts and yards. The lecturer asks us to examine the reasoning of those who desire to abolish the old way of training sea-

men. We do not want to abolish the old way of training seamen ; it has abolished itself. We cannot help ourselves ; we must keep pace with the times. He said, also, in some cases sail must be used, or the work must be left undone. I confess I do not quite understand that argument. I do not know a single station on which the work cannot be done by steamers, and I think sharp men will always get coal somehow, by hook or by crook. As far as I know, since steam has been introduced, one cruiser has been doing the work of three in the old days of sailing ships ; and I know of no work that cannot be done by steamers. If our neighbours would only guarantee to give us six months' notice before going to war, I should like to see our ships masted again, and then we could take the masts and sails out when war was imminent ; but we cannot expect any such notice as that. War may be sprung upon us at a week's notice or less, and we must be prepared for it, and as Captain May says, if we keep the men in training-ships too long, they do not know how to fight the fighting ships in which they have to meet the enemy. No one regrets the loss of sails more than I do, but we are compelled to do without them. My first command was as Flag Captain in a Training Squadron, one of the finest that ever left these shores, under Admiral Randolph. They were six fine frigates, and I look back to those days with great pleasure but also with great regret when I know I shall never see such a fleet under sail again. A squadron like that was a magnificent sight to see, but we could not help abolishing it. With regard to fleet manœuvres, I would like to say one word. I do not quite agree with some Officers who talk about it being so much more easy to manœuvre ships than it used to be. I believe it requires more nerve and judgment to manœuvre a fleet of big ironclads under high speed than it did in the old days to manœuvre a fleet of sailing ships. In the old days of sailing ships if a collision did occur, what was the result ? Perhaps a mast or two came down, but there was never much harm done to the hull of the ship. Now, if a collision occurs, if one or both vessels do not go down, they usually have to come back to dock to undergo a long repair. So that the question of manœuvring fleets under steam is a very important one indeed and requires practice. With regard to young Officers and seamen keeping the sea : It is absolutely necessary that they should do so, and as long as we have these masted ships with single screws, I see no harm in their being employed in that way ; but it must always be done within reach of the telegraph, so that they may be treated as a peace fleet, and the crews kept ready to be turned over for fighting when necessary. It is very important that young Officers and seamen should be kept at sea, more than they are now, in the Channel and Mediterranean Fleets. The junior Officers should learn something about ocean winds and currents, and should have an opportunity of seeing foreign ports, and also learn practical navigation. I should like to see every Officer, before he receives his Lieutenant's commission, obliged to produce a certificate, stating that he has actually navigated a ship under a navigating Officer for six months.

Captain VANDER-MEULEN : Captain Johnstone has read a most able paper, and I am so much in accord with all his views, that I have nothing upon which to disagree with him. I would, however, wish to say this, I have been brought up amongst sails all my life until within the last three or four years, and I have commanded for three years a mastless ironclad. I am going out to a mastless ironclad again, and I can only say that the crew that I should like to have are men that have been trained in the Training Squadron that Captain Johnstone talks about. I should like to see those men on board the Training Squadron for a whole year, but I believe that cannot be done. As it is, they are there only for six months, but allowing that we can only get our seamen through a drill of six months, that even is a great advantage. And allowing that they only touch machine-guns, that they do not touch heavy guns or anything else, I am much more pleased to have those men in an ironclad than I should be to have men who had been bustling about among guns all the time. I am quite sure that there is so much gained both in mind and body by the association with sails and the responsibility that is brought on both Officers and men in training aloft, that to do away with the detached squadron would be a terrible thing for the Navy. At present we have masted vessels, and we are likely to have masted vessels for a considerable time. We have ships that, with patching up, will last for a long time, and I do hope most

certainly that we shall not do away with the Training Squadron. I can only say, looking at the crew in a mastless ironclad, I would sooner have men who had gone through six months in a training-ship than any other class of men you could give me. They are the men I wish to command, they are the fellows that have more resource than men who have been on board mastless ships only. I have seen it, and I know about it. As I said, I have been three years in a mastless ship, and I am perfectly convinced that, if we do away with masts and sails as a training for men, we lose an immense deal in the Navy.

Admiral P. H. COLOMB: Really, Sir, Admiral Bowden-Smith has said most of the things I was thinking of saying. I think the paper is a good round Tory paper, drawn with a great deal of skill, because there is not one of us having grey hairs who does not inwardly sympathize with it. Whatever we may say outwardly and officially, our inward thoughts are with the author. And that of itself constitutes a difficulty, because our business in criticizing a paper of this kind is to get rid as much as we can of this inward sentiment, and to come to the cold reason of the thing. I think with Admiral Bowden-Smith that the lecturer was not quite fair in the way in which he seemed to set out that there were people in the Navy who were trying to drive out, simply from viciousness, the old seamanship. I think Admiral Bowden-Smith is perfectly right in saying that we are in a hole as to that matter; we are like an Irish landlord in the hands of a Land Court, we would be very glad if we could see our way out of it, but we cannot. Therefore I think it is not quite fair to those who have taken any part in pressing on, for the efficiency of the ships, the question of dispensing to a greater or less extent with sail power—I do not think it is quite fair to couple them all up as, for instance, wanting to start a new system, or lowering the high qualities of Officers or men, or being "opponents" of masts and sails and so on, or as those who desire to abolish entirely the old training of the seamen. I am quite sure there cannot be one of us who would want to do so. What is before us is to endeavour to see things as they are, and to do that which circumstances demand with as little change as possible. That seems to me the trouble, and I think the lecturer found that trouble himself very distinctly in his last paper when he came to the conclusion that it would be necessary to put Marines in the place of Bluejackets, and to reduce the number of the latter. That, I say, showed the difficulties that are before us. Then I think another thing is not quite fair, and that is to throw a great name like Sir Geoffrey Hornby's at our heads, for it is very difficult indeed for anybody in the Navy to argue against any utterance of his. We know that he thinks so carefully, and speaks so straightly, that we must be very shy indeed of saying anything on the other side. The one point—which I think I adverted to on the former paper of the lecturer—in which this paper seems to me to be wanting, is proof that the disappearance of masts and sails is deteriorating the seamen. It has been going on for a long, long time; it could not have gone very far, I think, at the time of which Sir John Hay speaks, when he was serving on the Committee of the House of Commons, and yet we are told that then the deterioration had begun. How very far it must have gone since, if this was so! But respecting that, I cannot help reflecting as I heard Sir John Hay speak, that I should like to have had the cross-examination of Captain Shaw, for it seems to me possible that he was more affected by the presence of continuous service than by the absence of sails. The right sort of men did not quit the Navy at all.

Admiral Sir GEORGE WILLES: He told me what he told Sir John Hay.

Admiral COLOMB: But I think if I had cross-examined him I should have shaken him a bit, because you must recollect he could only get either the old men pensioners or else the men who disappeared from the Service for the good of the Service itself. He might have thought it was want of activity; it may have been the activity that he saw was the activity of the inefficient class of men in the Service who were not capable of remaining in the Service. I agree with the lecturer when he says that it does not follow that in educating a man you are to put him at once to the sort of thing that he will ultimately have to do. We all agree to this, and our system of education in the country bears testimony to it. But the proposal, as far as I have understood it, is going further than that. It is to take away the people from the fighting education to give them an education which is not

preparatory, but in the middle of their work. If the lecturer had proposed simply an increase of time, for instance, for the boys when they got into the training brigs, which I believe, by the way, is only about six weeks, I think we might agree, not only in the theory of the thing, but also in the practice. But where the proposal is that you should take the men away from the fighting training, and from the ships in which they will have to fight, for the purpose of putting them under another system of living, which is not that with which they will ultimately have to deal, here I think we cannot quite so well agree. It was mentioned that salt beef was supposed to have an ill effect on the boys' stomachs, but we have a very high authority for saying that is not the case. Lord St. Vincent said very distinctly the thing which hurt seamen was fresh meat—that a great deal of disease came from the use of too much fresh meat. There was a very quaint phrase that fell from the lecturer's lips that struck me with great force, and I congratulate him upon it, and that is when he spoke of the necessity of this country not being in too great a hurry to advance new implements of war. It is a very old fad of mine that this country, at the head of the navies of the world, is pursuing a very wrong policy when it does anything more than simply follow up what other countries are doing; that we should not go in for the new weapons; they come upon us in quite time enough, and give us quite trouble enough when they come, to prevent our taking steps to advance them. I must say the paper is most skillfully drawn, and exceedingly pleasantly written. It has been a most agreeable paper to listen to; but I think that the lecturer has not been quite fair to the "opponents of masts and sails," as he called them, and I should have felt much more cordially inclined to him if he had not quite taken up the position that he has. At the same time I do feel very cordially inclined to him, because he has touched a sentiment which lies at the root of all our feelings on the matter, and I only wish that those sentiments could have their way.

Admiral TRACEY: I very cordially agree with what the last speaker has said. I came here with the intention of saying a few words, in fact, the lecturer and myself have had a little communication on the subject before to-day, and I gave him some of my opinions, which he has answered uncommonly well. I think the paper is one of the most logical papers I ever heard read; it is about as close as you could wish to have it; so that the only way would be to attack the premisses. If you shake the premisses I think the rest logically falls. If one acknowledged that all the very great qualities of our seamen in the past were mainly due to the fact of their having masts and sails to work, the question would be practically decided, but I am not prepared to accept that. I am not at all sure that it is not possible to have a system of training, in fact, I feel convinced that a system will come out eventually, by which our men will be as well trained as ever, and will maintain that superiority which they had before. The moment that masts and sails lost their *raison d'être* as a means to an end, I think, logically, they were gone, and as Admiral Bowden-Smith remarked, we have not abolished seamanship, it has abolished itself. Educating people to work with weapons that they are not going to have to use would be a very fine thing to develop them if we accepted the premisses, but the question is not whether we should like to do it, but whether we can. It comes to a question not what we should like to do but what we can do. My own belief is that there will be a system, a system of gymnastics, which will do this. At present it is done in the Swedish Navy, and by its means the men are trained most wonderfully. Every man goes through this course of training. In the old days we know very well that amongst the seamen in the big ships there were some very smart upper yards men, and they were generally kept there, I do not think the seamanship went so very much through the ship; I do not think every man on board went through it. However, that is not the point. I feel convinced that a training may now be produced which will do all that was done in the old days, and that the idea of keeping men in the Training Squadron, much as some people would like it, cannot be successful. I think there are a good many who would like to do it, but the thing is impossible; the men themselves see that they are being educated in what they are not likely to do afterwards, and their heart is not in it. I must congratulate the lecturer on the paper he has read to us. Almost all I had to say I have said to him before, so that he knows my opinions on the matter.

Admiral Sir GEO. WILLES : Mr. Chairman, this morning I employed myself in reading over what I have said on former occasions in this theatre as well as at the Society of Naval Architects, and I find that I really can add nothing to-day without repeating myself. I feel, however, very strongly on the subject under discussion, and therefore I must state that I greatly appreciate the able and logical paper which has been read by Captain Johnstone ; speaking generally, I approve of all he says. But I am afraid he is flogging a dead horse. I have reason to believe that the fate of the Training Squadron is already settled, and that on the recommendation of naval Officers. Captain May's figures were at once challenged by Sir John Hay, I am happy to say. If his figures are correct and if it is thought for one moment that 11,000 men could be retained in ships which are not to be the fighting ships in war, I should consider it absurd. What I proposed and what Captain Johnstone proposes, and other Naval Officers who think like us, is this, that we should maintain our boy-training system, as well as what is called the Training Squadron, and that we should also employ the single-screw ships on distant stations—the Pacific and China, for instance—where the ordinary duties can be performed as well under sail as under steam, but as to advocating that you should place masts and sails in the fast twin-screw cruisers to which Admiral Bowden-Smith has alluded, I do not believe any sane person would do so. Masts and sails are no use in such vessels and are gone for ever.

Admiral BOYS : I concur with my friend Sir George Willes that the days of sails are gone, and no one can deplore it more than I do. In fact, one feels quite depressed to think that we are to have no more sailing ships in the Navy. The training of seamen in sailing ships I look upon as being equivalent to Latin and Greek as a foundation for an ordinary education. When some of us present were young, no doubt we were midshipmen of mastheads or midshipmen of tops, and had young, smart fellows about us. They had not only to exercise their hands but their wits also when they had to rig the top-gallant and royal yards, furl the upper sails in a squall, and do it smartly and well. If anything went wrong they knew the consequences. This made them sharp. They would jump about the mast-heads with no thought of risk in the slightest degree, and this laid the foundation of that agility, intelligence, and daring which were the characteristics of our seamen in those days. I agree also with what has just been stated, that we have still in our single-screw ships, where masts must be retained, the opportunity of giving that training in seamanship which would be so useful and would lay the foundation of what seamen should be after they have served in them. I revert to my own old ship, the "Warrior," I have the same feeling for her that a man would have for his old friend, and I believe, even now, in the event of war there is a rôle for that ship and for her sister ships ; to perform a duty which could not be done by any other ships in the world. She might be used as a training ship, she could make a passage and keep a station under sail on the trade routes, and, having a large crew, could replenish the crews of other vessels : She might carry a large cargo of coals, could either fight or run, and, in fact, be made a sort of dépôt for convoying cruisers. I will not go into that any more, because my time is past. There is one remark of the lecturer's to which I think I might take some exception. He says : "The modern high discipline of the Navy was initiated by a Commander-in-Chief in the Mediterranean." I believe we know to whom he alludes, but I do not think that is quite fair upon the predecessors of that gallant Officer. I need only refer to a ship which I believe was the smartest, the best disciplined on the station, and altogether as perfect and efficient a war-ship as ever floated ; she had a crew of 1,200, and our gallant Chairman was the Flag Captain of that ship. I allude to the "Marlborough," in the Mediterranean, in the days of Sir William Martin.¹

Commander LEWIN : Captain Johnstone says that nothing is left but gymnastics and boat drill. Now, having been away from the Navy some little time, I had the pleasure of revisiting last autumn the Naval Manœuvres, and nothing struck me more than the intelligent way in which the bluejackets went about their work.

¹ The lecturer here explained that he was referring to the "Marlborough" and her days.

The drill with guns and torpedoes appeared to have educated their minds far in advance of what I remembered with the old topsmen and top-gallant yards' men—honour be to their ashes! No one could admire them more than I did; but the sailor of the present day has been educated by his guns and his torpedoes in a way that was not possible for the bluejackets of former days. When the Channel Squadron was refitting in Portsmouth Harbour last time, I had the pleasure of going round the "Camperdown" with a gentleman who was a civil engineer. We picked hold of a bluejacket and got him to take us round, and he explained everything to us—guns, torpedoes, and everything else. My companion asked me, "Who is this man?" I did not know. I asked him myself, and he told me he was a second class signalman, but the replies that he gave, the description he gave of the guns, the torpedoes, and everything else connected with the ship, showed a standard of intelligence which surely must count for something as put against the mere handling of masts and sails. It seems to me that the guns and torpedoes offer an admirable training for the intelligence of the seamen.

Captain ST. JOHN HORNBY: As my first years in the Royal Navy were spent almost entirely in sailing ships where I saw more of the real bluejackets than I have done lately, perhaps I may be allowed to say a word or two on the subject of this lecture. I would preface my remarks by saying that no one regrets more than I do the passing away of the smart seamen of the old style. I was brought up in a 50-gun sailing frigate; in a sailing three-decker, and then in a 12-gun brig; (afterwards in screw ships and so on); therefore, I, for one, especially, regret that the time of the smart top-gallant and royal yardsman has passed away. However it has gone and we have no choice but to go with the times. The lecturer has alluded to the distinguished French Admiral, Jurien de la Gravière, and he quotes one of his remarks as to "the fleet which is the fittest to brave the tempest," and so on. But the thing is what is the fleet and style of ship which is fittest to brave, &c.? It certainly will not be, at least not in these days, the ship with heavy top-hamper and rigged with masts and yards and sails. What would anyone think of our Mediterranean Fleet if it was composed of a large number of ships heavily sparred and rigged, and war was suddenly declared? You would be caught unready. In these days we all know very well that in all probability there would be no declaration of war; the telegraph cables and wires would be cut and war would be commenced at once. Let us turn to history and remember what is written when there was every probability that there would be war between England and France. It was about the Syrian question. The French Admiral, Lalande, coolly wrote to the Minister of Marine—you will see it mentioned in this Officer's despatches—the English fleet at that time was only half-manned; we had a great number of ships out there, but they were only half-manned; and the French Admiral coolly proposed that he should pick a quarrel with the English Admiral, and fight an action with us before our ships could be reinforced by more seamen. He knew our ships were only half-manned, and he calculated that an easy victory would result. Do not you think this might occur in the present day if you have these proposed large Training Squadrons? If a great number of our seamen and boys, 5, 6, or 8 thousand men, were locked up in these training ships, away from England, and war was suddenly declared, you would be without your men, and your men and ships would be destroyed, or blockaded in some port away from England. They would try to take refuge somewhere, but if the enemy had an opportunity of destroying them he would do so, and therefore I think this locking up so many men in the Training Squadrons would be very detrimental to the British Navy. Another point—What does a "good sailor" mean at the present time? It certainly does not mean the same man we had before in the Navy, but it means a man who is capable, whether Officer or seaman, of performing his various duties with the greatest ability, energy, and dexterity in the ship of the time and with the weapon of the day. The ship of the time is a "floating-fighting-machine." The training that these boys get in the training ships and in the brigs, certainly is a grand foundation, but when they have completed their training they will have to go into the war-ships and you must make the best of them you can. No doubt a great difficulty presents itself in the continual changes that are taking place in every profession, business, and department of life, whether in a merchant's office,

in the Mercantile Marine, or anywhere else. Whether in school or college, or anywhere else, the tendency is to change, and I do think the present style of educating boys in the training ships and brigs is as much as you can expect, and that after they have done that, they must be drafted into the seagoing ships and do the best they can in the ships they will have to fight, and with the guns and weapons with which they will have to fight.

The CHAIRMAN: Gentlemen, with me the difficulty is like that of my distinguished brother Officers, Sir John Hay, Admiral Boys, and others of our standing. I will attempt to speak of what should be done in the future. I can only speak of the great value of what we have had in the Royal and Merchant Navies of our country. I do feel the deepest anxiety in the apprehension that we are going to abandon the seaman's training of the past. It appears to be in the minds of all naval Officers here, that seamanship has been, and still is, of the greatest value, and that they would most ardently wish and desire to retain it; but some Officers who have spoken, do not think that it can be retained in the present day. I deeply grieve to think so. It is not the opinion nor the policy of other nations. It is not the policy of France. On the contrary, the French attempted, to some extent, to do away with training ships and the exercise of seamen aloft in their seagoing ships, but they found the result so injurious to what their best Officers believed to be the efficiency of their Navy, that they went back, and they have now more training ships, more seamen under training in ships with sails, than we have. No ship, whether an ironclad or unarmoured ship, goes to a foreign station from France without masts and sails. I met, this time last year, coming out of the Mediterranean, a very fine armoured ship of the "Bayard" class, fully rigged, going to China or the West Indies. I spoke on the subject to some French Officers, who told me that "All our ships going to foreign stations have masts and sails, because we wish to keep up our seamen." Remember, gentlemen, what France is doing, what she is sacrificing to train her seamen. Why has there been all this difficulty about the Newfoundland question? Do you think it is only a question of their trade connected with salt fish? Not so; it is a question of training and keeping their seamen for service in the Navy. What does all their expenditure in the North Sea mean? Why do they sacrifice so much for that? Because they intend to keep up their seamen for the Navy. Recollect, also, that by the French system every man that makes the sea his trade, every man that makes the river within a certain distance of the sea his trade, must pass through a course of training in the French Navy; and there are still a great many sailing ships under the French flag. Look at the Naval Exhibition, which is so much on Admiral Bowden-Smith's mind, and for which no man has done more than he has done, or can do more. Look at those fights that are shown in the galleries, and remember who fought those battles and gained those victories. Not trained seamen, but merchant seamen, forced into the Navy by the Press Gangs. Look at that picture of Lord Howe going down the Channel with thirty-one sail of the line, which were got together in an uncommonly short time. How many trained seamen were there in that fleet? They were nearly all merchant seamen. There were thousands of merchant seamen pressed into the Navy. What was it that gave them the superiority that they had over their opponents? The French were better gunners, and, as is well known, at long balls the English fleet would have suffered material damage. What gave them their superiority was that quality which our gallant lecturer so well describes, of "seamanship." I could say a great deal more upon this question. I regret very much to find that it is the opinion of Officers so distinguished in the Service at the present time, that we can no longer continue to train our men as seamen. This being so, henceforth we shall have an entirely different class of men to deal with in our ships.

Captain JOHNSTONE (in reply): If I attempted to answer a good many of the observations which have been made, I should be merely repeating the arguments of the paper. If I omit any others that I ought to take notice of I must apologize for passing over them by accident. I will, first of all, say with regard to Captain Hornby's suggestion that the danger of keeping our men in sailing ships is that an enemy's fleet might catch them at a disadvantage, that it is generally held that our fleet ought to be superior to those of two foreign nations at least, and that our peace

fleet is kept up irrespective entirely of the total number of men that we have. The number of men actually in the Mediterranean would depend only upon the policy of the Foreign Office at the time. Of course we must necessarily have a reserve to put into the ships required for fighting, so there would be no difficulty about that. With regard to the great rise in intelligence that Captain Lewin notices in the men, I think, perhaps, he has not taken into account the general increase of education throughout the country; and, no doubt, when you go away from men-of-war for a certain time and then come back again you will find that the men have improved in intelligence. With regard to the particular man that he picked out, if he was a signalman it would show that he had not anything to do with either guns or torpedoes; so that I do not think the training of guns or torpedoes can be held to account for the great intelligence displayed by that individual man. Admiral Bowden-Smith, I think, made a mistake as to what my proposal was. I thought I had endeavoured to make it as clear as I could that I accept the present situation as regards our ships completely. It is impossible to go back from the condition in which we find ourselves. Our modern fighting ships are of a certain description, and to attempt to put masts and sails into them would be ridiculous. The only astonishing thing is that people never saw that, years before. One look at ironclad ships many years ago, should have been sufficient to convince anybody that masts and sails were entirely out of place in them; and, I believe, part of the discredit into which masts and sails have come, is due to the fact that they have been forced upon ships that were entirely unfit for them. There is no space to work the sails, and they evidently would not move the ships; so that we cannot attempt to put masts into ships that are not suited for them. I alluded entirely to ships still in existence, ships made of iron or steel, which would last for ever with care, and would take in more than the whole number of men that we want to send to sea. I noticed that both Admiral Bowden-Smith and Captain May failed to put clearly before us what we are going to do to keep our men up to training. Nobody puts that forward. They say, in a general sort of way, "Oh, you have gymnastics or boat sailing; you have the exercise with torpedo booms, and so on." That is all very well; but we must remember that there are no two ships alike, and in order to get things done smartly we must have competition; we must have one ship able to give some fair comparison with others, and you cannot do it with these ships. I quite believe in the exercise of hoisting out boats in the old-fashioned ships; it was, no doubt, capital exercise, but how are you going to carry it out now? There are no yards and stays to man: all you have to do is to turn on the steam winch. There is no sort of exercise in that; no sort of competition between vessels, because if there were, the danger would be that people in their hurry would overrun the engines and carry things away. As far as you can have competitive drill, by all means have it; but everyone who speaks on the subject fails to put forward anything that you can clearly use as a means of competition. With regard to keeping station under steam and under sail, I do not think an Officer of the watch under sail will agree with Admiral Bowden-Smith, that it is easier to do it under sail than under steam, particularly in the case of an inexperienced Officer. He would very soon learn how many additional revolutions he was to put on in order to keep station under steam; but he would take a very long time to learn how to do it under sail. In the Training Squadron, I always found at first with Lieutenants that the moment he found he was getting out of station he turned all the watch up at once. One thing they had to learn was the actual number of men that they ought to get up, how few men they could do with, and how little alteration of sail was necessary. This forms a great matter of instruction to Officers, but I do not see anything in the steamship by which you can exercise the men in that way. Admiral Colomb and, I think, Admiral Tracey also, appears to undervalue the advantage of establishing a standard by which you can judge people. Admiral Colomb says that I proposed to reduce the number of seamen in order to give the higher training. Certainly, because I attach the greatest possible importance to having the higher standard. It is quite true that in the old ships it was not the whole of your men that you got on the upper yards; there were a great many who stopped down below

who did not join in the exercises requiring the greatest exertion. But you established the standard; your standard was established generally by your upper masts and yards, and those men kept up the standard of the whole ship. No doubt it was better for the upper yards men to be changed occasionally; but supposing that they were not changed, you still had the standard of smartness; it would be known that the exercises could be done in a certain time, and that would make the men exert themselves to the uttermost. So that the point is to establish a standard, to get the thing up to the mark. Now I think Training Squadrons would establish the standards of the whole Navy in the same way. A Training Squadron in which people are brought up to a certain pitch of smartness would unquestionably keep up the standard throughout the whole Navy. I think Admiral Colomb remarked also that there are no proofs of deterioration of the men. I can only say the proof of deterioration is the opinion of different Officers. I am told that some years ago, when the "Devastation" was in the Mediterranean, and the only mastless ship, you knew a "Devastation" man at a distance. It was common repute that a "Devastation" man was known because she was a mastless ship in the fleet, and they knew him by the look of him. I would ask any seaman who does not know, fifty yards off, whether a man is a seaman or a stoker? I venture to say, anybody knows who it is; there is an evident difference. I should like to call attention to the evidence that Captain Acland has given. Captain Acland succeeded me in the Training Squadron. I formed my opinion from what I saw in the Training Squadron, and Captain Acland appears to have come to a similar conclusion. The strongest proofs we can have on this question is the evidence of Officers, as far as possible, who have been in both sort of ships, masted ships and mastless ships, and I think Officers who have been in ships with masts and sails, even if not also in mastless ships, will at any rate know what the effect is upon the men. I think no stronger testimony can be given than that given by Captain Vander-Meulen. The best sort of testimony is that of a man who has been first in masted ships and then in mastless ships, and then says he would like in a mastless ship, to have men who have been trained in ships with masts and sails. It appears to me no better evidence can be had. There was also the evidence given in this theatre at a discussion some time ago, when I remember a young Lieutenant got up and said "masts and sails were all passed by, and torpedoes and gunnery were the great thing." But directly afterwards an Officer, who was, I think, the First Lieutenant of the "Sultan," got up and said he did not at all agree with him—he was a Lieutenant of considerable standing—and when the "Sultan" was on shore "the petty officers they found of most use were those who came to them from the Training Squadron." This, no doubt, is a matter of opinion, but I am convinced that many Officers who think now that we have nothing to do but to train up our men in accordance with the things we have to our hand in the mastless ships and that the men will keep just as good, will alter their minds in a few years' time when the change in the men begins to take place; and nobody can pass through a Training Squadron without being convinced of its effect upon the men. I think at present the men pass through it too quickly. I know many people consider the Training Squadron men are not kept up to the proper mark. I quite admit that they are not brought up to the best standard of discipline, but the reason is, they only stop there for six or nine months. It is like having to re-commission your ship every six months, which is very disheartening to Officers, and prevents your getting up to the standard you ought to have; so that if the Training Squadron does not produce the good results it ought to do, it is due to that fact. But everybody who is acquainted with the Officers and men from a Training Squadron will observe the difference between them and the rest of the seamen. I can only hope the intention to do away with our Sailing Squadron, may be deferred as long as possible.

The CHAIRMAN: Allow me to add what I omitted to say before. I took a passage of some weeks in the "Devastation," and the impression on my mind at the end of it was in accordance with what Captain Vander-Meulen says. I have omitted to call attention to the American Navy. There you perceive they are not doing away with masts and sails, and are anxious to keep up their seamen. With regard to what Admiral Tracey said as to gymnastic exercises in the Swedish Navy,

those who have spoken with Swedish Officers must be aware of the great importance they attach to keeping up seamanship. It now only remains for me to invite you to do what I know you are so anxious to do, to thank Captain Johnstone for his admirable paper. Whatever our difference of opinion as to the views he has stated in it, we are at one as to its value and interest, and I quite agree with what has been said here, that it is a most interesting and instructive paper on a very important subject.

Wednesday, June 3, 1891.

ADMIRAL THE RIGHT HON. SIR JOHN C. DALRYMPLE HAY,
Bart., K.C.B., F.R.S., &c., Vice-President, in the Chair.

SOUNDING MACHINES FOR THE PREVENTION OF
STRANDINGS, WITH SPECIAL REFERENCE TO JAMES'
"SUBMARINE SENTRY."

By Professor LAMBERT, M.A., Royal Naval College, Greenwich.

THE CHAIRMAN: It is hardly necessary for me to introduce Professor Lambert to the members of this Institution. His subject is one in which not only sailors but soldiers, who cross the deep so often, are very much interested. We have the advantage also of having the presence of the President of the Royal Society, Sir William Thomson, who, as you know, has done so much in this particular matter as to deep sea soundings, and whose scientific authority on all subjects is recognized by all the world. I trust that he may be able to throw some additional light upon the subject, which, I have no doubt, will be so admirably put before us by Professor Lambert.

THE Board of Trade Returns for the year ending June 30th, 1889, give records of a total of 2,153 strandings of British ships, and show that in 325 of these cases total loss resulted, involving the sacrifice of 115,083 tons of shipping and 232 lives.

The total tonnage either actually lost, or in danger of being lost, through strandings, amounted in the year to 1,269,994 tons, representing a money value of about 25,000,000*l.* sterling.

It appears also that more than 50 per cent. (335 out of 601) of the total losses were due to strandings.

A consideration of any means by which we may hope to diminish the frequency of this fatal disaster at sea must obviously commend itself to underwriters and shipowners, and to Naval Officers responsible for the safe-conduct of the ships they command, and to all who are concerned in the safety of human life.

I propose in this paper to give a short account of the various types of sounding machines which have been invented with the object of indicating to a captain the approach of shallow water, and especially to bring to the notice of this Institution the latest, and, I believe, an entirely novel, departure in this direction, namely, the "Submarine Sentry."

Meanwhile a glance at some of the more modern deep-sea sounding apparatus, as used for telegraph cable work and general ocean-bottom exploration, will, I hope, prove interesting.

A special feature of the history of deep-sea sounding machines is the great improvement in handiness and compactness which has resulted from the use of fine steel wire of high tenacity, instead of the Manila or hempen rope formerly employed.

The older forms of deep-sea sounders, up to about the year 1870, were of a very bulky description. I believe that some used in the early cable expeditions had sinkers as heavy as 6 cwt. On the "Challenger," a hempen rope was used, and sinkers weighing 4 cwt. were frequently employed.

A drawing of the sounder actually used on the "Challenger," a "Hydra" machine, as modified by Lieutenant Baillie, R.N., and with which soundings of, I believe, 4,575 fathoms were taken, is here shown. It consists of a hollow iron tube, 5 feet long, with butterfly valves opening outwards at the lower end. On striking the bottom, a sample of the ocean bed was forced into the tube and retained by the valves, the heavy sinkers being automatically detached and lost.

As a contrast to this bulky arrangement, we have the beautiful machine invented by Mr. Lucas, of the Telegraph Construction and Maintenance Company, and now in use by that Company and on Her Majesty's surveying vessels. I have here one of the smallest machines, designed for soundings to 400 fathoms, also a photograph of one of the largest, which is intended for soundings to 5,000 fathoms, and weighs, complete, less than 2 cwt. The wire employed with the large machine is No. 22, S.W.G., and weighs about 14 lbs. per 1,000 fathoms, and the drum from which it is unwound is only $14\frac{1}{2}$ inches in diameter. A sufficiently rapid descent of the sounder is assured by a sinker of only 50 lbs. weight, which is automatically detached on striking, a pair of open metal jaws at the same time closing and retaining a sample of the bottom.

In all sounding machines, the management of the brake and the general control of the paying out are of the utmost importance. Mr. Lucas has devised a brake arrangement which is beautifully simple, and almost entirely self-controlling. The wire, as it is paid out, passes over a small measuring wheel, the number of revolutions of which record on a dial the number of fathoms out. A powerful band brake, which can stop the machine instantly, is kept out of action by the tension of the wire during the run out; but, when the sinker strikes bottom, the loss of tension allows the brake to spring back; the paying out stops, and the depth can be read off at once on the dial. For the first hundred fathoms the speed is gently controlled by a small hand brake; afterwards the machine is left to itself entirely.

Of course all deep-sea sounding machines require the vessel to be stopped before they can be used. I have to deal in this paper specially with the machines designed for the shallower soundings, which are taken as precautions against stranding, and without stopping the ship.

In the leisurely voyages of the past, time was of little importance, but in our days soundings must be taken when the ship is under way, perhaps even while going at full speed, or they will often not be taken at all.

An early and easily available record of sounding at sea will be found in Acts xxvii., where we read, "About midnight the shipmen deemed that they drew near to some country; and sounded, and found it 20 fathoms; and when they had gone a little further, they sounded again, and found it 15 fathoms; then fearing lest we should have fallen upon rocks they cast four anchors out of the stern and wished for the day."

The primitive, but still ever useful and reliable hand-lead, no doubt

used on the occasion just alluded to, has done its work for more than 2,000 years. It was probably the only sounding machine known to our forefathers.

Coming to modern times, we find that the records of our own Patent Office for the present century give specifications of more than a hundred different inventions for soundings at sea. An examination of these leads to a division under five classes:

1. Rotating sounders.
2. Air-tube sounders.
3. Pressure gauge sounders.
4. Electrical sounders.
5. Various.¹

The principle on which the rotating sounding machines act is that the motion through the water revolves the blades of a small screw, like a ship's propeller, and the depth attained is deduced from the number of revolutions and recorded on a dial. They are, in fact, simply patent logs designed to act vertically. They are useless, of course, for flying soundings, except at low speeds, as they measure the length of the path through the water actually taken by the sounder. They will not record the true depth unless their path is exactly vertical, which is a difficult condition to ensure, even when plenty of slack is allowed to the line. The errors introduced by the varying friction of the revolving parts, and by the spinning of the line, are additional elements which make these machines uncertain in their records.

Among the air-tube sounders, probably the best known is Sir William Thomson's. This consists of an outer metal case, containing a long thin glass tube, 2 feet in length, closed at one end, and coated internally with a red colouring matter (chromate of silver). As it descends the increasing pressure forces the water into the open end of the tube and compresses the contained air. After reaching the bottom the sounder is hauled in, and the tube is examined on board. The distance to which the water entered is indicated by the washing away of the red colour, and the number of fathoms of vertical depth attained is read off by applying to the tube a specially prepared scale.

The method of graduation of this scale is interesting, and depends on the simple law that the volume of any given mass of air, or other gas, decreases in the same proportion as the pressure upon it increases. Assuming that the pressure of the atmosphere is equal to that produced by 5 fathoms depth of sea water, if AB be the length of the tube, B being the closed end, at a depth of 5 fathoms, the pressure would be equal to that of 2 atmospheres, and the water would reach C, the middle point of the tube, forcing the air into half its original space. At a depth of 3 times 5, or 15 fathoms, the pressure would be 4 atmospheres, the water would rise to D, three-quarters up the tube, the air only occupying one-quarter of the length. The tube being 24 inches long, if the water rose up

¹ I have to thank Messrs. Hughes and Son, of Fenchurch Street, for the loan of many of the instruments exhibited in illustration of this lecture.

22 inches, compressing the air to 2 inches (one-twelfth of its original volume), this would record a pressure of 12 atmospheres, or the depth of 55 fathoms.

This recorder is subject to errors: (1) due to change of barometric pressure, and (2) due to difference of temperature, a variation of 1 inch in the barometric height requiring about a 3 per cent. correction, the depth recorded being too great when the barometer is low. Also if the instrument be taken, say, from the warm atmosphere of the captain's cabin, and plunged into cold sea water, there will be a contraction of the air in the tube, over and above that due to increased pressure, and in this way a 5 per cent. error might be introduced, the maximum error possible, due to both causes working together, reaching, perhaps, 11 per cent., an amount rarely, if ever, approached in practice.

In Cooper and Wiggzell's instrument, an example of which is before us, the pressure of the water forces a piston up the tube against the tension of a spring. A pointer, which cannot advance but which moves back with the piston on the subsequent contraction of the spring, shows how far the piston has moved, and indicates on a scale the corresponding depth in fathoms. At the closed end of the tube there is a fairly large reservoir of air, the back pressure of which is not much affected by the comparatively small space through which the piston moves. The graduations are much more uniform, therefore, than with Sir William Thomson's tubes, and do not get so inconveniently crowded together near that end of the scale which shows the deeper soundings.

In Basnett's instrument water enters the tube, as in Sir William Thomson's, and compresses the contained air, but it is trapped and not allowed to escape. The quantity of water thus captured indicates on a scale the depth attained. This appears to be a simple and reliable instrument.

The machines to which I allude under the head "Pressure gauge" act in a similar way to the well-known Bourdon steam-pressure gauge, the principle being that pressure applied to the interior of a bent tube of elliptic or flat oval section tends to make the section more nearly circular, and this leads to a straightening of the tube. In these sounding machines a curved tube of elliptic section, to the interior of which water has access, whilst the outside is protected by a water-tight jacket, has its curvature diminished by the pressure of the water entering it. This change of curvature is mechanically recorded, and indicates the corresponding depth on a dial. This class of machine does not seem sufficiently reliable to meet with much favour.

The delay in ascertaining the depth, due to the time occupied in winding the machine in after striking bottom, is often of serious consequence. Various electric devices have been invented for giving an immediate record on board. Electric apparatus is, however, proverbially capricious in its action, and I do not think that any of the electrical sounders have met with any great measure of practical success.

Messrs. Cooper and Wigzell have devised a very pretty arrangement, in which the regular increase of pressure in advancing the piston of their sounding tube (lately described) alternately makes and breaks an electric current, maintained through the wire, causing a step-by-step advance on a small dial on board, and thus indicating the depth which the sounder has reached at any time during its descent, the motion on the dial stopping when the pressure ceases to increase.

Under the head of "Various" are comprised a large number of inventions, the majority of which are of a more or less fanciful and unpractical nature, and, with one exception, I do not intend to particularize them.

Burt's "Bag and Nipper" is not included in this list, and certainly deserves mention. It consists of a canvas bag inflated with air, which is put overboard when the ship is either at rest or moving at a moderate speed. Hanging from the lower end of it is a small block containing a sheave, over which the lead line from the ship passes. The end of a flat brass spring presses the rope into the groove of the sheave. When the bag is set adrift, the line is rapidly paid out from the ship, and the lead runs down vertically under the bag carrying the line over the sheave. When bottom is touched the line stops running, and the edge of the spring nips the rope, not allowing its return. The "bag," always to be seen from the ship in daylight, when relieved of the weight of the lead, naturally bobs up in the water, thus telling that bottom has been reached. By night, the line running through the hands of a practical sailor is felt to slack a few seconds on the lead getting "bottom." The bag and line are then hauled on board, and the depth is marked by the point where the line was nipped.

This, though one of the older machines, is still a favourite with many navigators, and has not been entirely displaced by more modern inventions.

The great fault of the ordinary methods of sounding with the object of avoiding strandings is the danger arising from the lapse of time between two successive casts. A certain cast may show plenty of water, but the ship may be two miles away, and on the rocks, before another cast can be taken. This is not only a probable event, but it is the usual event. The histories of strandings are nearly all alike; the ship's "protest" is usually something to this effect: "The weather was thick and foggy; the sky overcast; no lights to be seen; the position of the ship not known, except by dead reckoning. The captain gave orders to slow down; a cast of the lead showed so many fathoms; another cast half an hour later showed so many fathoms. The master ordered the lead to be kept going at intervals; the look-out reported breakers ahead; the engines were reversed, and the ship struck." It is nearly always that the ship is lost in the interval between two successive soundings. I may even go further than that, and say that ships are often lost because soundings which would have saved them are not taken at all, on account of the labour they involve.

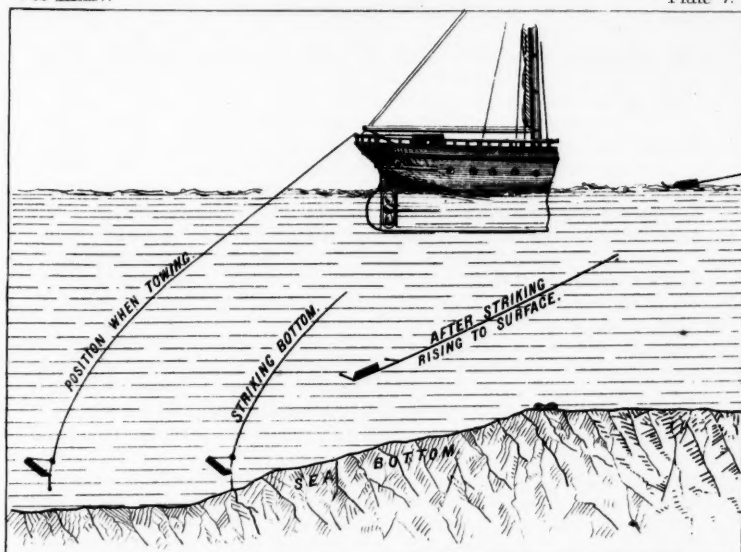
To do away with these intervals, and to avoid the heavy labour of frequent successive soundings, and to provide, instead, a continuous under-water look-out, involving no labour, and requiring little or no attention, and which will give instant warning of dangerous shallowing, is the object with which the "Submarine Sentry" has even invented (see Plate).

The apparatus is the outcome of experiments conducted at sea during the last two and a half years by Mr. Samuel James, C.E. I may mention that I have taken a great interest in the progress of the invention from the commencement, that it has been my privilege to assist in many of these experiments, and that I speak from practical experience of the reliability of the machine, and the ease with which it can be manipulated.

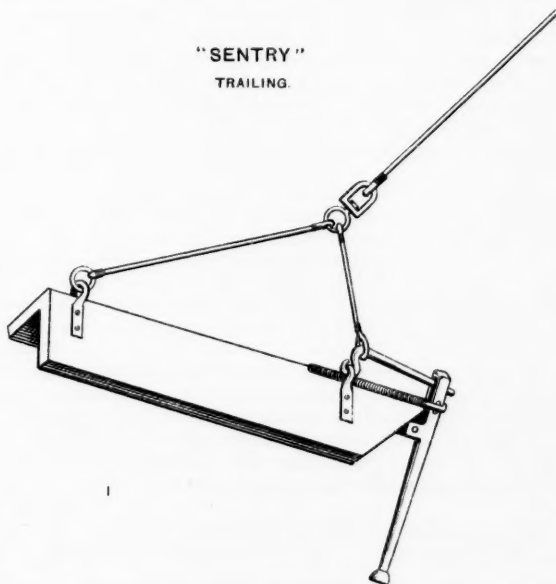
The "Submarine Sentry," as its name implies, is intended to give a continuous under-water look-out, and automatically to give warning of the approach of shallow water. It consists of an inverted wooden kite, which can be trailed from the stern of a vessel at any required depth to 45 fathoms. On striking bottom the blow, acting on a projecting trigger, releases the slings of the kite, and causes it at once to rise to the surface and trail in the wake of the vessel. At the instant of striking the sudden loss of tension in the wire sounds a gong attached to the winch on board. The wire used is of steel, and of the highest tenacity attainable. Its diameter is 0.067 inch, and it is capable of bearing a stress of fully 1,000 lbs. Three samples which I had tested gave a mean breaking stress of 1,020 lbs., representing the very high tenacity of 129 tons per square inch of section. During towing the vibration of the wire causes a continuous rattle in a sounding box, and the cessation of this noise gives an additional indication when the "Sentry" has struck bottom. The vertical depth of the kite at any time is indicated on the dial plate of the winch.

The curve formed by the wire while towing is concave downwards, as shown in the sketch, and has been very carefully plotted. At first sight it would appear as if this curve would change its form, and the sinker trail further astern, and at less depth, when the ship's speed was increased. This is not the case. The form of the curve, when a given length of wire is out, is practically unchanged by any variation of speed between 5 and 13 knots. As this is a point of the utmost importance, it may be well to look for an explanation of the fact by considering the forces which are acting when the "Sentry" is towing. The weight of the kite is made equal to, and is therefore neutralized by, its own buoyancy, and the weight of the wire is negligible compared with the forces due to the motion through the water. The forces, therefore, which remain to be considered are only: (1) the fluid pressure on the kite; (2) the fluid pressure on the under-side of the wire; and (3) the tension of the wire, which is the result of (1) and (2).

Now pressures due to fluid motion vary very nearly as the square of the velocity. If, therefore, say, the velocity of the ship be doubled, the forces (1) and (2) will each be multiplied by 4, and their resultant, the tension, will also be multiplied by 4; the three forces will



"SENTRY"
TRAWLING.



all be changed proportionally, and there will be no change in the directions in which they act. This is only offered as a rough explanation. There is no doubt about the fact, and it is found in practice, that a change in speed from 5 to 13 knots does not cause a variation of more than half a fathom in 30 in the depth of the sinker. The towing of a small boat at the side of a ship may be appealed to as illustrating the principle, for anybody may observe that the angle made by the tow line with the ship's course is independent of the speed. The towing of a Harvey torpedo on a ship's quarter is another example.

The graduations of the dial for vertical depths may be relied on, as their accuracy has been verified by numerous comparisons with Admiralty soundings, under all conditions of speed and weather.

Although the apparatus and the principle on which it acts appear of so simple a character, yet the problem of working out the most perfect design is one which has cost Mr. James two years of thought and experiment. What is wanted is, of course, the maximum sinking power with the minimum of tension in the wire.

Now it will easily be seen that the thicker the wire is the greater will be the upward pressure of the water upon it, and the more the downward motion of the kite will be resisted. Also, the larger the kite is the greater is the fluid effect to force it down. The question arises whether a small kite with a fine wire would not answer as well as a large kite with a thick wire. Equal sinking effect could, no doubt, be obtained, but it can easily be shown that in the former case the line would be far more likely to break. For suppose we halve the area of the kite, and halve also the diameter of the wire, we shall get the same sinking power with a given speed, and all the forces, including the tension, will be halved. The area of the section of the wire will, however, be only one-fourth of what it was before. The ratio of the tension to the section of the wire is therefore doubled, and it follows that it is far more likely to break. This seems to suggest the use of a large kite and a stout wire. No doubt a large margin of safety in the strength of the wire could be thus assured, but the bulkiness of the machine would then be objected to. The actual dimensions chosen are a judicious compromise.

In connection with this point, Mr. James remarks, in a letter to me, "I stopped increasing the size when I got a kite which I myself, a landsman, and not a very strong one, could and did handle alone in a fearful gale of wind."

It is not intended that the machine should be used at speeds greater than 13 knots. It could be adapted for higher speeds, but this is not considered necessary. A captain doubtful as to his position, and anxious about the depth of water under him, would hardly steam at a greater rate than 13 knots. The wire easily bears the steady tension produced by towing at this speed, and it has then a factor of safety of about two to one.

During the past year a few cases have occurred of kites being lost in consequence of the jerk produced by a too sudden application of

the brake in the hands of a nervous or inexperienced man. A spring adjustment has now been added to the brake lever, which prevents it being too suddenly applied, and this risk has been reduced to a minimum if not altogether removed. I find from personal experience that this modified brake gives perfect control over the paying out. It is, nevertheless, advisable to slow down to about 7 or 8 knots before putting the kite over. The speed may be increased to 12 or even 13 knots after the sinker has reached the depth at which it is to be trailed.

Although the primary object of the machine is to act as an under-water sentry, trailing for any length of time at a set depth, yet single soundings to 45 fathoms can be taken with it at any time while the ship is under way, and for this purpose it is as reliable and handy as any machine hitherto invented. All that is required to do is to set the slings of the kite, put it over the fair-lead, and pay out slowly with a hand on the brake. The gong will sound when the bottom is touched; the kite will rise to the surface and a glance at the dial will show instantly the vertical depth, *without waiting to haul in.*

The depth to which a kite will sink when a given length of line is out depends upon the angle to the horizontal at which it is made to trail, and this is influenced by the form and dimensions of the triangle formed by the sling, and by its position relative to the centre of fluid-effect on the kite. This centre of fluid-effect is, of course, in the prolongation of the direction of the towing line at the point where it is fastened to the sling.

Setting the sling fastenings further back, without altering the distance between them, obviously gives a steeper slope to the kite. The maximum sinking effect is obtained with an inclination of about 53° . This would be far too steep in practice, except for slow speeds, as it would set up too severe a stress in the wire. The flatter the angle the less the ratio of the tension to the sinking power. With the object, therefore, of diminishing the stress on the wire, the angle adopted is the smallest admissible, consistent with the kite being able to descend to such depths as are sufficient for all practical purposes.

Two kinds of kites only are issued with the machine, the one painted black, which will be the one commonly used, for depths down to 30 fathoms, and the other painted red, which is set at a deeper angle, being specially designed for use at depths between 30 and 45 fathoms, and will be rarely needed.

The red kite can be used for *all* depths down to 45 fathoms. Since, however, with a flat angle the tension is less than when the same depth is got with a steep angle, the black kite is preferable because it puts the wire, to less tension. There is a limit, however, to the sinking power of the black kite, as, after a certain depth is reached, no amount of extra line paid out would cause it to sink much deeper. This limit is attained at about 35 fathoms, and for depths between 30 and 45 fathoms the red kite is to be used.

With the black kite, slowing down to 7 or 8 knots is not really necessary, although it is advisable, for flying soundings at $13\frac{1}{2}$ knots

can be taken with it by a practised hand, but with the red kite slowing down should be insisted upon.

The stress on the towing wire varies almost exactly as the square of the speed, a good approximate rule applying to the black kite being, "The stress in lbs. equals three times the square of the velocity in knots."

For the red kite it is *five* times the square of the velocity instead of *three* times.

The following table, framed on this rule, gives results which are almost identical with the average indications of a Salter's dynamometer:—

Speed in knots.	Stress on wire in lbs.	
5	75	} For black or ordinary kite.
6	108	
7	147	
8	192	
9	243	
10	300	
11	363	
12	432	
13	507	

It will be seen from this table that the tension rises with the speed in a rapidly increasing ratio, and that while at 7 knots there is the very large margin of safety of nearly 7 to 1 (the breaking tension of the wire being 1,000 lbs.), at 13 knots it is reduced to 2 to 1, and only an experienced hand should be allowed to put the kite over while the ship is going at this speed.

The question has been asked how much of the horse-power of a ship is absorbed in towing the "Sentry." This is easily calculated. Taking, for example, the black kite, towing at 8 knots, or, say, 800 feet per minute, at a depth of 30 fathoms. The wire, as it leaves the fair-lead, is in this case nearly horizontal, and the work done by the tension of 192 lbs. acting through 800 feet per minute is about 153,600 foot-lbs. per minute or a little over $4\frac{1}{2}$ horse-power. This is a small tax on modern marine engines, and is a trifling cost to pay for the safety assured by the "Sentry" in dangerous waters. In fact, when we consider that the "Sentry" will generally only be used for short periods, while there is any anxiety as to the position of the ship and the depth of water under it, the cost of this horse-power is simply negligible, mounting, in consumption of coal at the rate of 2 lbs. per I.H.P., to about one penny per hour.

I have dwelt perhaps too long on the force-problems which present themselves in connection with the "Submarine Sentry," forgetting, perhaps, that they may not be so interesting to the majority of my hearers as they have been to myself.

With reference to the conditions under which the "Sentry" will be valuable at sea, I venture to quote a few extracts from an article written on the subject by Commander Carpenter, R.N., who is, I

believe, an experienced marine surveyor. Commander Carpenter says:—

“In these days of great speed and rapid passages, in fair weather or foul, such an instrument gives at once an enormous saving of anxiety and time. In vessels with but a small crew it is notorious that the casts of the lead are few and far between until in such depths that the hand-lead can be used. To save his crew from the continuous work of the deep-sea lead, the captain of a vessel will in thick weather slow his speed down, and remain on the bridge all night anxiously peering through the gloom for the loom of the land. By this course a whole tide may be lost in arriving in port, and on the score of saving anxiety alone it is probable that every captain of a vessel will in future have one of these machines at his elbow. We will take the case of a vessel making for the Bristol Channel from the westward in thick or rainy weather. Observing that the 30-fathom line runs about 10 miles off the Cornish coast, and about the same distance off Milford Haven, and about 5 miles outside Lundy Island, a captain would ease his speed for a few minutes when yet some 35 miles off, and put over the machine, allowing the wire to pay out until the indicator showed it to have descended to 31 fathoms, or whatever the excess sounding was likely to be at the 30-fathom line on account of rise of tide. Continuing his original speed again, he would receive instant warning when the 30-fathom line was reached. If now any single light was in sight, he would have a very good idea of his position. If no light was in sight, he would reset the machine and tow it at 20 fathoms depth, proceeding slower until some light was sighted. If no light was in sight on reaching 20 fathoms, it would be time to reverse the course till the weather cleared. Similarly, taking the case of a vessel bound up the English Channel—where it is known that about 16 fathoms will keep clear of all shoals from the Start to the Downs—the sinker can be let down to the fixed depth of 16 fathoms, and as soon as the vessel gets off her track and crosses the 16-fathom line (or other set depth) the warning is given.”

Describing the working of the “Sentry,” he says:—

“The kite or sinker is first slung according to instructions and it is then lowered to the surface of the water. Then, easing out the wire tow-line rapidly by means of a brake, the heavy end of the sinker dips; the strain of the passing water acts on the whole, and down it goes straight to its position, the sounding-box immediately setting up its rattle. On running into the depth set for, the trigger strikes the bottom, releases the sling of the kite, which then floats at once on the surface. The rattle of the sounding box ceases; the wire reel, which is heavy for its size, having been pulled out of the perpendicular by the strain on the wire, now swings back and strikes a gong. The look-out man attending the machine reports that the rattle has ceased, or that the gong has struck; the ship's speed is slowed, and the sounding perhaps verified by a cast taken either with the same machine or with a hand line.

“With a little practice, one person can put the sinker overboard,

take the sounding, and reel in again. In a trial of this machine, in the Firth of Clyde, a new bank was discovered by its means, on which the depth was found to be as little as $6\frac{1}{2}$ fathoms where the chart showed 26 fathoms."

A glance at a chart of the North-West Coast of Spain shows us that at 3 miles off the coast where H.M.S. "Serpent" struck there are depths of 42 fathoms, and it is probable that within 1 mile of the rocks there exists not more than 30 fathoms. Had a "Sentry" been in use from that vessel whilst passing Cape Finisterre, it is not too much to say that warning would have been received in time to admit of the helm being put over, and thus a terrible calamity averted.

That the "Serpent" might not have been lost had she had a "Sentry" on board is the opinion of many naval Officers with whom I have conversed on the subject.

The stranding of the "City of Rome" on the "Fastnets," off the west coast of Ireland, in June last, in spite of frequent soundings at intervals, was distinctly due to the want of such a *continuous* guard as the "Sentry" would have afforded.

Illustrations of this kind might be multiplied almost indefinitely, but there is no need for me to particularize them before an audience the majority of whom know far more than I do of the history of maritime disasters.

The machine has now been in use for some months on ships belonging to the Allan Line, Clyde Shipping Co., Royal Mail, Forward Bros., and other shipping firms, and most satisfactory reports of its performance have been received. The master of the "Aranmore," belonging to the Clyde Shipping Company, claims to have come round from Glasgow to London through the thick fog of last November, which will be so well remembered, without the loss of a single tide, feeling his way with his "Sentry;" and the master of the Royal Mail s.s. "La Plata" reports that during his last voyage to Brazil and River Plate, he made frequent trials of the "Sentry" at depths from 11 to 40 fathoms, and at speeds from 4 to $12\frac{1}{2}$ knots; that it always worked satisfactorily, and that he could give the "Sentry" no higher recommendation than by saying that it does exactly what is claimed for it.

The Hydrographer of H.M. Navy, after a trial between Plymouth Harbour and the Thames, immediately ordered a machine for H.M.S. "Rambler," and another machine has subsequently been asked for. I hear also that enquiries, and at least one order, have lately come from foreign Governments.

I feel, Mr. Chairman, that I have been somewhat presumptuous in reading this paper before the Institution. The subject is one which would be brought before you more appropriately by a sailor than by myself.

It is because I happen to have had special facilities for following the development of the "Submarine Sentry," and that I have seen enough of it to convince myself that it is no fanciful creation of an enthusiastic inventor, but a proved practical success, and that it will

not only be useful to the marine surveyor, but will, by affording to the captain of a ship ready warning of impending danger, tend largely to the security of navigation, that I have ventured to bring the "Sentry" to your notice, believing, as I do most firmly, that its adoption will largely diminish the number of maritime disasters and the present deplorable loss of valuable lives and property at sea.

SIR WILLIAM THOMSON, P.R.S.: Professor Lambert's historical introduction is seriously defective, and, no doubt without any intentional unfairness, conveys an erroneous idea as to the superseding of hemp rope, by pianoforte wire for deep sea sounding, in his manner of contrasting the "Hydra" machine used on board the "Challenger," with the machine constructed by Mr. Lucas, which is before us. He has omitted to remark that in 1872 I obtained a sounding of 2,700 fathoms by pianoforte wire in the Bay of Biscay, which was the first successful use of wire for deep sea soundings; that the Admiralty, on my recommendation, put a machine for sounding by wire on board the "Challenger," which was not used; that a little later I supplied a sounding machine with pianoforte wire to the United States Navy Department, which was used successfully by Commander Belknap in the soundings in the Pacific, even to so great depths as 4,000 fathoms; and that in April, 1874, I exhibited to the Society of Telegraph Engineers a machine for deep sea sounding with pianoforte wire, made according to my design by White, of Glasgow, for Messrs. Siemens, to be used on board their cable ship "Faraday." All this preceded the adoption of steel pianoforte wire by the Telegraph Construction and Maintenance Company, and gave them the mechanical method of using wire so as to avoid the troubles which had rendered all attempts failures to use it, prior to 1872. The "Proceedings of the Philosophical Society of Glasgow for the Session 1873-1874," and the "Proceedings of the Society of Telegraph Engineers¹ for 1874," contain drawings and descriptions of the machine supplied to the "Faraday," and a full statement of the facts to which I have referred regarding the origin of the use of steel wire for deep sea soundings. Professor Lambert's references to my navigational flying soundings are defective in not noticing my depth recorder, in which the divisions are practically uniform throughout the scale, while he points out the inconvenience of the crowding of the divisions towards one end of the scale in my compressed air depth gauge. His statement of two "errors" to which he says my depth gauge "is subject" is wholly inaccurate. Correction for the barometric pressure is given in the printed instructions for the use of the instrument. It is applied without the slightest difficulty, and the reading of the depth is incomplete without it. The error due to temperature is practically nothing. However warm the glass tube may be when it is taken out of store, it takes almost instantly, with practically perfect exactness, the temperature of the cold brass sheath in which it is placed for use. This sheath is always kept lashed on the moist, plaited hemp line, to the lower end of which the sinker is attached. If in any circumstances the brass sheath becomes warmed by the sun, nothing is easier than to cool it down to very nearly the temperature of the sea, by a cloth dipped in freshly-drawn sea-water, or by pouring sea-water over it. Now I proceed to a much more agreeable part of the task you have imposed upon me, that is to speak with great admiration of the invention specially brought before us by Professor Lambert. Mr. James deserves congratulation, I think I may say, for his success in solving so extremely difficult a problem as that which has been very clearly explained to us by Professor Lambert. To cause a kite, let us call it so for brevity, to take a constant depth below the surface of the water, whatever the speed of the ship may be within certain limits, is Mr. James' problem. The theoretical proof of his solution of that problem has been put with perfect clearness and demonstrativeness before us by Professor Lambert. The weight of the kite is nothing on the whole, because its

¹ "On Deep Sea Sounding by Pianoforte Wire" (paper communicated to the Society of Telegraph Engineers, April 22nd, 1874). This paper is reproduced in vol. iii of my "Popular Lectures and Addresses," published recently.

middle part is floated by the wood of which it is constructed, and, as Professor Lambert has pointed out, the weight of the wire is practically nothing in comparison with the forces concerned. By the law of resistances, according to the square of velocity, we see clearly that the form of the wire, the inclination of the wire to the horizon, and therefore the depth to which the kite is kept below the surface, will each be equalized for all speeds. I confess myself, remembering, as I do, the great unsteadiness of kites in the air, I should have expected that the kite would take dives and sway about, and would give a much less steady result than that which experience seems to have proved that it does give. With the facts before us, we cannot doubt but that a valuable appliance for use at sea is put before us. One application I must say seems to me likely to be of very high importance, and that is to surveying. One of the most difficult things that surveyors have to do is to find a rock, to pick up a rock perhaps you may say in nautical expression, even when there is absolute evidence that a rock is somewhere within a very moderate region of sea. Effort after effort has been made sometimes, and after many days the trial has been abandoned, resumed again, and then, after a long time, we find that the rock is there: so difficult is it to hit upon a rock of not large area with the ordinary method of letting down the lead. But by the continuous method of dragging a body along at constant depth below the ship, it is obvious that if there is a ridge to be found, the finding of it is made certain by going once over it, if it rises above the depth to which the kite is set; and even in the case of an isolated spot of rock, the chances of finding it in any moderate time are very much improved indeed, by the continuous method which Mr. James' machine supplies. With reference to the use of James' machine in navigation, I would observe that its object is altogether different from my navigational sounding machine. The object of my navigational sounding machine is to let the navigator know where he is when he is still far from danger, and running at 14, 16, or 18 knots. In that way the navigator, feeling his way in depths of from 100 to 50 fathoms, knows with great certainty whereabouts he is. He knows when it is time to slow down, if slowing down is necessary. He knows exactly how far he may proceed with safety, taking a cast every five or ten minutes, or as often as judgment tells him he ought to take it, to do all that can be done for the safety of his ship. By this means, before coming near the shore, he can find whereabouts he is by the well-known process of marking off parallel courses on the chart, and finding where the soundings most nearly agree with those that are found by the soundings. I may conclude by referring to a lecture which I myself had the honour to give before this Institution on February 4th, 1878,¹ in which the application of the method of frequent soundings to ascertain the place of the ship is fully explained, and illustrated by an example, with copy of course drawn on the chart, for a case in which the last 288 miles of a voyage from Madeira to the Solent were got over in thirty-three hours, with no other guide than my sounding machine. I have only to add, in conclusion, an expression of my hearty congratulations to Mr. James, and my thanks and congratulations to Professor Lambert, for having produced such an exceedingly interesting result as that which is now before us.

Captain WHARTON (Hydrographer to the Navy): Mr. Chairman and gentlemen, I must also allude in few words to the same subject that Sir William Thomson did at the beginning of his remarks, although it is somewhat ungracious to do so, as the lecturer told us that he especially deprecated taking up the position of a great authority on the history of obtaining soundings. But it does seem, in the present day, that a history, however sketchy, cannot be given of the improvements made in taking soundings in late years, without referring to Sir William Thomson as the great moving spirit in this matter, and that any omission with regard to steps that he has taken and principles that he has laid down must be a very serious one in a paper of this kind. I will now proceed to the more important subject of the paper. I may say at starting that I was very much pleased and taken with the idea when it was first explained to us. I think the principle is a very great advance, or may

¹ The part of this lecture now referred to, with a reduced copy of the chart by which it was illustrated, is to be found in vol. iii of my "Popular Lectures and Addresses," pp. 377, 386.

be a very great advance, on anything that we have had previously, for the reason that if perfect it is self-acting, and requires no looking after. At the same time, that principle of trusting entirely to an automatic machine is a source of very great danger. I am sure we shall all of us, as sailors, say that we would far sooner trust a "look-out" under any circumstances than we would trust to any machine, knowing that no machine yet has ever been perfect, and the probability is no machine ever will be perfect. I have not used the machine myself, but on hearing of it I sent an Officer to see one of them working in a ship coming up the Channel, and I received, on the whole, a very favourable report. But I will now also follow Professor Lambert's principle of picking holes in the existing machines, and apply it to this. One of the facts that came out in this experimental cruise in the Channel, was that the machine is liable to go off at half cock, as we may call it; for it went off on that occasion without striking the bottom. That, of course, is an obvious defect. I have spoken to Mr. James about it: he is fully aware of the importance of trying to obviate it, and I hope he will be successful, because if "wolf" is constantly called, the value of the machine is very much lessened. Professor Laubert has spoken about the small corrections necessary for Sir William Thomson's machine. There are also some things which detract from the perfection of the machine before us. The depth to which it goes entirely depends upon the angle of the kite, and a very small variation, I should imagine, would make a difference of a fathom or two. I understood Professor Lambert to claim accuracy within a fathom or two of 20 fathoms, but I do not think he will get it. Then there is a question as to the limit of usefulness. We have been told that the black kite is useful to 20 fathoms, and that the red kite, which is a more dangerous one to use, inasmuch as it is at a greater angle, and therefore you must be very careful how you get it over,—is available up to 45 fathoms, but not for greater depths. That is a very serious drawback. Sir William Thomson's navigational machine you can use at all depths up to 100 fathoms. You may use it anywhere near land, and you can, with the very smallest trouble, find out your depth. There are plenty of cases where ships have to run in for land where the 50-fathom line is uncommonly near the shore, and if vessels run in, trusting to this instrument, they will use it in a way that was not intended by the inventor, and they would not be saved by it. On that point Sir William Thomson's sounding machine has a very distinct advantage. I am very much obliged to Sir William Thomson for having so well set out the difficulties that we have in surveying, in finding small rocks. I think even Officers have no idea of the amount of labour, time, and close look out required to find a small rock. It was for its use in the direction pointed out by Sir William Thomson that my attention was directed to the "Sentry," and I have ordered two machines for two surveying vessels that are now in the Red Sea looking for rocks, and there is no doubt in that matter it will be most useful. I have received letters from the ships, saying that the "Sentry" is working very well. Of course they go at low speed, and we cannot test what might happen at high speed, when, as I have said, it is a little liable to "go off at half cock." There is one little inaccuracy in the paper. The bank in the Clyde was not found by the "Sentry." The bank in the Clyde was known before the ship with the "Sentry" on board went there; but no doubt the "Sentry" hunted down the place where the bank was known to exist, and struck the bank, although it was not originally discovered by the "Sentry" machine. I hope there may be banks discovered by the "Sentry," and I have no doubt whatever that there will be some, but the "Sentry" should not get the credit for discovering that bank in the Clyde. Having called attention to what I consider the present defects and possibilities of drawbacks in this machine, I will only say, in conclusion, I think the idea is most excellent, if it can only be brought to perfection.

Admiral COLOMB: I think, Sir, the general impression must be, in consequence of the lecturer having so often drawn attention to his want of knowledge of the subject, that we shall hope he will favour us on future occasions many times with lectures on other subjects of which he knows nothing. I have been a little surprised at the course the discussion has taken, as if there was some antagonism between this machine and other machines, especially Sir William Thomson's sounding machine, which has been mentioned. In following the lecturer it did not strike me that he was attempting to draw any distinction between the two, because, as far

as I understand the matter, the occasions for the use of James' machine and those of Sir William Thomson's are totally different; and when the lecturer spoke of defects, of liability to error, in Sir William Thomson's instrument, I thought he was speaking scientifically but not practically. I presumed that he knew that Sir William Thomson has made all the corrections necessary, and if he had not done so, we of the Navy would have heard of it long ago, and Sir William Thomson's sounding machine would not have carried with it the very high favour which it enjoys. It is something new to us, as Sir William Thomson's compass was, which preceded it, of which it was said that at Portsmouth the Officers sitting on court-martial were so impressed with the necessity of adopting universally Sir William Thomson's compass, that they could not keep it out of the Minutes of Proceedings, no matter what the charge was. If a blue-jacket in the height of his exuberance blacked a petty officer's eye, and was tried by court-martial, the Admiralty of that day said it was almost certain that some member of the court would ask whether the ship had Sir William Thomson's compass on board, if he did not suggest that the offence was due to the want of it. It is the same with the sounding machine as far as I know. The James' instrument is introducing to the marine what was introduced for the safety of railways, it is a sort of "block system." If you have machines which require special handling to ascertain the depth, you won't get it because of the trouble. You won't get the depth, and you won't be warned of the danger unless you take those steps; but with the James' instruments you set your machine at the block, and if it is as good as represented, it will, without further trouble, prevent your train from going on the wrong line and warn you of danger before you come to it. The lecturer spoke of so many strandings occurring from the lapse of time between any two casts. My own experience is that the loss of ships from stranding arises, almost entirely I was going to say, from not taking any cast at all, and that is why I think the position of this instrument is so strong, because it obviates the necessity so far; it will correct your forgetfulness or your neglect in spite of yourself. I will mention an instance where I think a ship certainly could not have run on shore had she had this machine on board. I am speaking of the "Euphrates," which ran on shore near Tarifa, the Captain supposing himself at the time to have passed Gibraltar and to be in the Mediterranean. She had a heavy, foul current with thick fog; she did not get soundings, she mistook where she was. Her position would have been this if she had this machine on board: she would have set it when she first got into the difficulty, and it would have been left towing. She would have gone on and made her mistake, but as the trouble lay on the side of getting the kite in, it would have been left in action. If it were neglect to have left it over, this very neglect would have been the saving of the ship. My connection with this machine is rather curious. I had the idea myself in my mind twelve or thirteen years ago, and I went so far as to make a kite with line, on a very rough and small scale, and to try it in a small steam yacht. The whole thing was exceedingly rough, but I came to the conclusion that the idea had soundness in it if worked out. I heard of it next by rumour, and not knowing my friend Mr. Lambert had anything to say to it, I spoke well of it the moment I heard of it, from my own experience with my own rough experiment. When I saw the actual thing I formed, I must say, the very highest opinion of it. I have not seen it used in deep water, but I have seen it and have used it myself in shallow water at a fair speed, 10 or 12 knots, and I am bound to say it is perfectly easily controlled, and that I could myself, without any trouble, get either a continuous sounding or successive soundings as I desired. I was very much struck on hearing Sir William Thomson's remarks, with the thought how very easy it is to follow in a path which genius has once given the clue to. We have had before us the use of pianoforte wire, and we know where that item came from. We have also had before us the method of compressed air for measuring depth, and we know where that came from. Had there not been the genius to show these things at the beginning, we should not have had the improvements or the changes in them which have since taken place. Captain Wharton, I think, rather exaggerates the danger of using the automatic machine, even if it were intended that this should supersede such an instrument as Sir William Thomson's; but from my point of view I have no idea that it should supersede it. It is an additional safety, and no more, as far

as I understand it. I think also the chances of its going off at half cock are not as great as might be thought. I have seen a great many of the reports of steamers that have used it, and I am under the impression that the only time in which a case of going off at half cock had occurred was the case of which Captain Wharton has spoken. No doubt there may be certain defects in the machine, but I think, on the whole, from the reports I have seen, that the danger is not so very great. The danger of the slings stretching I think also is minimized. The slings before they are placed in position are tested to a very high tension, and I do not think there is much more stretch in them. The angles are very carefully measured, and each one is specially regulated to make sure that the angle is correct. I think I have said all that is necessary, but I wish, before sitting down, to thank the lecturer very much for the paper he has read to us.

MR. EDWARD J. HILL: I should like, if I may be allowed, to say one or two words upon this paper. First of all, I congratulate Mr. James on having carried out this idea so successfully. Admiral Sir George Nares some years ago described to me his plan for conveying a line from a ship to the shore by means of a kite, and it struck me that other uses might be made of this idea. I worked very hard during the years 1875, 1876, and 1877, in trying to see if I could make Sir George Nares' kite travel in a downward direction under the water to show the depth. In January, 1878, I provisionally protected a plan which may be of some interest to Professor Lambert in his study of the various machines for sounding which he has referred to. This plan I christened the "Dolphin." A number of experiments were made by me off the Nore on a large yacht belonging to the late Sir Thomas Kirkpatrick, Bart. It was worked then by a towing wire as in flying an ordinary kite, and a second wire forming the tail, which recorded the depth it was down below the surface. I succeeded in obtaining some very good depths, but could not ensure more than 6 or 7 fathoms, and thinking this insufficient gave the whole matter up. Mr. James seems to have met with more success, and actually obtained, as the author of the paper informs us, a depth of over 40 fathoms. With regard to some remarks made of the trigger of this sentry going off sometimes before it touched the bottom, I may say I did find that my "Dolphin" kite always sprung out of the water when it touched the ground and trailed behind the ship, but it sometimes went off at 1 or 2 fathoms. I used no slip as in Mr. James' kite, but the "Dolphin" came up to the surface, and jumped out of the water like a fish, and the wire becoming slack, a gong or bell sounded. I used to enjoy my experiments, and termed it a fishing excursion. It was amusing to watch that "Dolphin" come out of the water when it touched the ground. I accounted for the coming up before touching the bottom by the "Dolphin" coming into contact with something below the surface. This may possibly have occurred in the case of this "Sentry;" it may have touched a fish which relieved the trigger. There is no doubt the kite or sentry of Mr. James is the realization of many people's ideas, and he deserves very great credit for having got a kite to go down to this great depth.

ADMIRAL COLOMB: I want to add one word as to steadiness. Sir William Thomson said he was afraid the kite would not be steady in the water. I can vouch from personal observation that it is entirely the other way. The remarkable steadiness is one of the things which strikes me. By looking at the point where the line touches the water you can see at once the variation of the ship's course. It is as if the line entered the water at a fixed point and never varied.

SIR WILLIAM THOMSON: What I said was, that I should have expected beforehand that it would not be so steady as Mr. James had found it, and I must congratulate him on having achieved a result which I could scarcely beforehand have thought possible.

ADMIRAL SELWYN: I think I must take some share of the blame, if there is any, resting on Mr. James' shoulders for changing the name of his machine, because, when he gave a lecture upon it at the Inventors' Institute, I at once protested against his calling it a sounding machine. Now it appears the change of name has not sufficed to banish the idea that it is nothing but a sounding machine. It is not anything of the kind; it is totally distinct, having different qualities, capable of doing things that no sounding machine, so called, can do, but at the same time per-

haps incapable of doing all the things that can be done by a sounding machine. I think if such a machine is calculated to save life and property, without going any further than the British narrow seas, to anything like one-tenth part of the amount put down in the paper before us, we may very well congratulate ourselves, as the President of the Royal Society has so well and generously done, on having got rid of one of the greatest difficulties of navigators in persistently shallow waters, where, notwithstanding fogs, they are bound to go steadily on, believing that everything is right on board ship. Unfortunately it is not always right. There are cases, well-known cases, in which, from either badly loading the cargo or something else, the compasses have gone wrong, and it is very well to be able to correct even the best compass if it does go wrong, or if a false impression is created by it. It does much more than this, for it enables men-of-war, without any great trouble to themselves, to cruise, fulfilling all the objects of their cruise, and yet giving a very fair idea of the locality and importance of shoals. I was with Sir Edward Belcher years enough to know what the evils of sounding are. Sir Edward Belcher insisted on 500 fathoms being run out and bottom being got if it was there if we were going anything under 10 knots. Our crew was hard worked all through a long surveying expedition for several years. It was very hard to snatch a few hours' sleep at night out of our watch below, and to take away that chance in order to sound with the ordinary lead and haul in that line again made an enormous number of our seamen quit the ship; they could not stand it. I think anything that supersedes needless work, even in a surveying ship, is an advantage, and I should say it would save more absolute hard work and give better results than any other method. In the long intervals when we are not running our passages, we have no particular course to keep, and if there be anything like a nest of shoals in your way you are delighted to go and find them, and if so done in this way, and we can do it without any material trouble, it will be done. For the Mercantile Marine I think it is so excellent a thing that, failing any action of the Board of Trade, whom we do not expect to take up these things—it does not seem to be their duty—I think the insurance companies might be induced to do something by way of relieving to a small extent the premiums paid for insurance of any ship that carried it. I think that is a legitimate conclusion to come to, and I hope Mr. James will as fully succeed in the pecuniary result, as I fully believe he has done in the automatic and mechanical nature of his admirable invention.

Professor C. F. LAMBERT, in reply: I may say I felt much honoured by Sir William Thomson's rising so early to speak on the subject of my paper, although he thought it necessary to find fault in some points. Perhaps the next best thing to being right in everything one says, is being corrected by Sir William Thomson. I admit the omissions to which Sir William alludes, but I do not think I have been inaccurate; it was far from my intention to depreciate what Sir William Thomson has done. I can assure you that I regard his services as quite unique in the history of modern science, and I know that, by turning his brilliant scientific abilities into practical channels, he has done more than any other man living to advance the science of navigation. I did not intend to give in my paper a historic account of sounding machines, or to commend one inventor, or one invention, over another, but I wished simply to describe the principles of action of typical machines as actually used up to the present time. A historic account would certainly have been seriously incomplete without far more allusion than I have made to Sir William Thomson's valuable contributions to this practical science. Sir William Thomson has said I omitted to mention his "depth-recorder." I omitted it because I took one sample only of each type of machine. I described Sir William Thomson's chemical sounding tubes, and then took Cooper and Wizzell's "Depth-Recorder," which is on practically the same principles as Sir William Thomson's. As regards the steadiness with which the "Submarine Sentry" trails behind a ship, and to which Sir William Thomson and Admiral Colomb have alluded as being a very valuable and perhaps unexpected feature of the invention, I may say that the "Sentry's" performance in this respect frequently elicits from sailors and others, who first see it in use, the remark that "It is as steady as a rock." It is a curious fact, as Admiral Colomb has said, that when the kite is once down, the point at which the wire enters the water is

steady enough to indicate, by its relative motion with regard to the keel, how the course of the ship is varying. I thank Sir William Thomson for the generous acknowledgment he has made of the virtues of an invention which certainly, whatever may be said to the contrary, does to some extent encroach as a competitor upon a field in which he himself has been a successful inventor. Captain Wharton has warned us against trusting too much to automatic machines. I do not think that in the case of the "Sentry" this warning is very necessary. One thing I am very certain of, and that is that the trigger of the kite must go off, and the signal be given to those on board, if the ship enters water which is shallower than the depth set for. Failure in this respect is a physical impossibility. If the trigger went off without striking bottom, on a certain trial to which Captain Wharton alludes, it was not a matter of any consequence, and would require only a slight adjustment of the spring attached to the trigger to prevent its doing so again. I can assure the Hydrographer that we have not heard a word of anything of the sort occurring since the occasion referred to. It gives none of us who are interested in the machine the slightest anxiety. With regard to possible error being introduced by the stretching of the wire slings, I can endorse what Admiral Colomb has said. The triangular sling is in every case so carefully set and stretched beforehand, that there is no danger of any possible variation of the form of it when once it has been put on. An old kite like the one before you, which has seen so much service, will give as accurate a record of depth now as when it was first issued. Possible difficulties pointed out by the Hydrographer are really, I think, not realized in practice; in fact the only anxiety I personally have had about the machine during the last six months, and this is practically removed now, has been how to prevent an inexperienced or nervous man from jerking when applying the break in paying out. In all other respects the machine seems to me to act perfectly, and the question of the application of the brake is the only one which has given us any trouble. Of course we do not expect that the "Submarine Sentry" will prevent a ship from stranding under all possible circumstances. I should say it will fully justify its invention if it prevents 3 or 4 per cent. of the strandings that take place in the year. Certainly if property to the value of 25 millions sterling is in jeopardy every year from stranding, and if the use of James' "Sentry" prevents one million pounds worth from getting into that condition, it will have proved a very valuable invention, even if we take no account of the loss of life it may have prevented. With regard to the discovery of the bank in the Clyde, what I read about it was a quotation from Captain Carpenter; I did intend to mention that it had really been previously discovered by a fisherman, and that it was picked up by the Captain of the s.s. "Aranmore," who went out of his course, trailing the "Sentry" with that object. I do not think I have anything more to say except that I am very pleased with the discussion, and I am grateful to the members present for their kind indulgence in listening so attentively to a lecture from me on a subject on which I feel myself so poorly qualified to speak.

The CHAIRMAN: I am sure you will desire me to express your thanks to Mr. Lambert for the interesting lecture which he has apologized for. We will not accept his apology. We are grateful to him for coming here, and bringing this most interesting subject before us, the saving of life at sea, the saving of national property, the safety of Her Majesty's ships, and as the Hydrographer has pointed out, giving actual facilities for discovering those dangers arising from shoals, and so preventing some of the shipwrecks which occur. I agree with the lecturer, that if Mr. James' invention can save 1 per cent. of the losses which occur, that the country ought to be grateful to him for the invention. I have taken an interest in this subject for fifty-five years, because fifty-five years ago I went to sea with an invention of Erichsen's. Erichsen knew the captain of the ship, afterwards "Sir Henry Bruce," the frigate in which I served in South America, and he sent him a lead which contained a glass tube, of which we see examples here, and a valve which did not keep in order all through the Commission, unfortunately, and therefore I believe Mr. Erichsen's invention was for the time discarded, perhaps because it was not carefully taken charge of. At any rate we did not often require to sound much lower down than 100 fathoms; we were satisfied with Burt's bag and nipper, and

we succeeded in keeping ourselves off shore at any rate. I believe Sir William Thomson himself would recognize that Mr. Erichsen was one of the first who made that discovery, or rather applied his scientific knowledge to the great use to which it has now, under its improved circumstances, been so far advanced by Sir William Thomson. (Sir WILLIAM THOMSON: That was the first use of the principle of compressed air.) These observations are of little value in themselves, but they are so far retrospective, and they are of this value, that they have drawn from Sir William Thomson the recognition that that which he has improved so greatly had its beginning in Mr. Erichsen's invention. I may now convey the thanks of the meeting to Professor Lambert for the interesting lecture he has given us, and also to Sir William Thomson and those Officers and gentlemen who have taken part in the discussion.

Friday, June 5, 1891

COLONEL THE RIGHT HON. VISCOUNT HARDINGE, A.D.C. to the Queen, Commanding 1st Volunteer Battalion Royal West Kent Regiment, in the Chair.

THE MOUNTED INFANTRY QUESTION IN ITS RELATION
TO THE VOLUNTEER FORCE OF GREAT BRITAIN.

By Lieutenant-Colonel E. T. H. HUTTON, p.s.c., h.p., King's Royal Rifles, Commanding the Mounted Infantry Regiment.

"In the present quality of war—
" . . . when we mean to build
" We first survey the plot, then draw the model,
" And when we see the figure of the house
" Then must we rate the cost of the erection,
" Which, if we find outweighs ability,
" What do we then, but draw anew the model?"—

SECOND PART, "HENRY IV."

LORD HARDINGE, ladies, and gentlemen,—It is now five years since I had the honour of delivering my first lecture upon "Mounted Infantry" before the members of this Institution. Lord Wolseley, then Adjutant-General of the Army, was in the Chair, and many of the distinguished gentlemen whom I now see before me were present, and took part in the discussion that followed.

The principle of raising and training a force of Mounted Infantry, then for the first time proposed in this country, has developed upon a scale which was beyond the expectations of the most enthusiastic of those present, except, perhaps, the Adjutant-General himself.

It bears upon my subject to inform those of the audience who are not aware of the fact that nearly every infantry battalion serving in this country (the brigade of Guards excepted) has a detachment of trained mounted infantry soldiers. The total number is approximately 65 Officers and 1,700 men, who are organized for mobilization into 12 companies. The Officers are specially selected for this particular duty by their own Commanding Officers, and the non-commissioned officers and men similarly chosen for their physique, their bearing as soldiers, and their shooting capabilities.

They serve as Mounted Infantrymen upon the understanding that they represent their own regiments in a corps specially organized for difficult duty, and that they return to their own regiments when no

longer required bearing with them whatever honour and credit they may have gained.

The companies so formed are complete in every respect, and ready to be mobilized for immediate service, either in this country or abroad. To this force is about to be added eight Maxim machine-guns. Horses and horse transport for eight of the above companies are registered for service in case of national emergency, and can be concentrated at Aldershot within seven days of the order being given, while the whole of the saddlery, camp equipment, and other stores are ready at Aldershot for immediate issue. This country has, therefore, a picked force of infantry marksmen who have been trained, equipped, and organized in such a manner that they may be given any means of rapid locomotion which is best suited to the service for which they may be required. I ask you to consider the enormous value of the fighting power possessed by a force of this description, which, consisting only of highly trained infantry under selected and carefully-trained Officers, stands possessed of the best fire-arm in Europe.

It will be within the recollection of many present, that a portion of the lecture referred to in June, 1886, was devoted to a proposal for the organization of a brigade of Mounted Infantry Volunteers upon the same lines as that proposed for the Regular troops.

The system proposed for the Regular troops has, as I have shown, resulted in a movement *successful beyond all expectation*, due to the military foresight and genius of the late Adjutant-General, who has been influenced doubtless by his knowledge and keen appreciation of the lessons to be learnt from the American War in 1861-65, as well as from his unique personal experience of war. The system proposed for the Volunteers has not yet got beyond an *embryo stage*, and though since that date there has been a remarkable increase in the number of isolated companies or detachments in various parts of Great Britain, these companies or detachments can only be looked upon as *isolated fragments* and disconnected atoms, and are, upon their present footing, inappreciable and useless factors in the general scheme for the defence of this country from the need of any proper system of organization or training. It seems remarkable that the Mounted Infantry movement should have developed at all among the Volunteer forces, when the depressing attitude towards it of professional military opinion is considered.

However, we know that all great military developments in this country are the result of the demands of public opinion. Our political history shows that no Government will ever vote supplies for any innovations upon existing institutions, until the public, through the Press, have demanded it, and will no longer brook refusal.

The substance of the lecture which I am about to deliver was given in the form of an address to the Metropolitan Volunteer Sergeants' Tactical Association in January last: and it is at the request of General Sir H. Havelock-Allan, who took the Chair on that occasion, and of General Lyon-Fremantle, D.A.-G., Auxiliary Forces, who was also present, that I now repeat it on the present occasion.

II.

You must forgive me if I begin by defining "Mounted or Mobile Infantry," and making a broad distinction between them and what may be best defined as "Mounted Rifles." It is essential that the distinction should be clear in your minds in order to follow my argument and proposed scheme.

Mounted or Mobile Infantry are infantry soldiers *pur et simple*, who are so organized, equipped, and trained as to be capable of receiving any available means of rapid locomotion to enable them to act as infantry soldiers with the greatest rapidity and mobility. Mounted Infantry may thus be provided with horses, ponies, mules, camels, elephants, or any mechanical contrivance which the climate and physical conditions of the theatre of operations renders most desirable.

Mounted Rifles, on the other hand, are defined as *horsemen* trained to fight on foot, men who are mounted and intended to perform all the duties of cavalry, except that which may be best described as "the shock." It is expected of them that they should perform all the outpost, reconnoitring, and patrolling of an army in a manner similar to cavalry; the only difference being that they must rely solely upon their fire powers for defensive and offensive action.

From the above it follows that, on the one hand, a "Mounted Infantry soldier" may or may not be mounted upon a horse, and that he need only be but a rough-and-ready horseman; while, on the other hand, a "Mounted Rifleman" must be mounted on a horse, and well mounted, while he must of necessity be a good rider.

The Mounted Infantry of the Regular Army are of the type indicated, and it is a force of the same description which I venture to propose to you for your consideration as applicable to the Volunteer Force.

I must now sketch to you, as briefly as possible, the (a) organization, (b) system, (c) training, (d) equipment, (e) tactics of the Regular Mounted Infantry, in order to make the rôle proposed for the Volunteer Mounted Infantry clear to you.

(a.) Organization: Taking the company as the unit for explanation:—It is composed of four equal portions, called divisions; each division is found by a separate regiment, and the Officer and men composing it remain together as a unit, which in this manner is composed of men selected to be representatives of their own regiment in a *corps d'élite*. Regiments having similar traditions and affinities are grouped together, thus:—

Detail of No. III or the Fusiliers Company, Mounted Infantry Regiment. (Field Army Table, p. 145.)
Captain St. G. C. Henry, 1st Battalion Northumberland Fusiliers, commanding.

Detail of a company in the field.	I Division. 1 Battn. Northd. Fus.	II Division. 2 Battn. Royal Fus.	III Division. 1 Battn. Lancashire Fus.	IV Division. 1 Battn. Roy. Munster Fus.	Grand total.	Remarks.
Major or Captain	1	...	...	...	1	
Lieutenants	4	...	...	...	4	
Company Sergeant-major	1	...	...	...	1	
Sergeants	5	...	...	...	5	
Corporals	6	...	...	...	6	
Sergeant-farriers	2*	...	...	...	2*	
Shedding-smiths	2	...	...	...	2	
Buglers	2	...	...	...	2	
Privates	99	...	...	...	99	
Dismounted men, servants, &c.	5	...	...	...	5	
Cooks and wagonmen ..	5	...	...	...	5	
Saddler	1	...	...	...	1	
Total	133	32	33	33	133	

* Sergeant-farriers who may be detached from the Cav. Regt. to serve on mobilization.

Companies thus organized are further grouped together and formed into battalions.

(b.) System: The whole success of the Mounted Infantry system is based upon the following principles, principles which experience has taught us to be vital to the efficiency of all troops in war.

1. The company system: That the administrative is also the tactical unit, and that each company has an organization complete in itself.

2. The squad system: That the company maintains permanently its four squads or divisions, each under its own Officer.

3. Permanent sections, or groups, system: That the four squads or divisions are divided into permanent groups or sections, so that the same men and horses shall be together in barracks, or at the bivouac, who work together at drill, or fight side by side on the field of battle.

4. That the Officers who lead must be those who instruct, whether in drill, riding, or discipline.

I trust that the learned Brigadier Commanding the Perth Volunteer Brigade will accept the assurance that this "group system," which he has so persistently and so ably advocated, is the "permanent section" system which Officers of the Mounted Infantry adopted eleven years ago, and have found, by practical experience, on every occasion, to be the foundation of true fire discipline. It must be to the genuine satisfaction of the learned Brigadier to know that this very system which he has advocated with such force and ability is about to be adopted for the whole Army.

(c.) Training: Each company is mobilized for instruction in riding, stable management, drill, and Mounted Infantry tactics for two months every two years. The infantry training of the soldier is carried on in the regiments to which the men belong. The two months' training in Mounted Infantry duty is found ample for the purpose, and a satisfactory standard of efficiency has always been attained in that time.

(d.) Equipment: The following articles are required in addition to the infantry soldier's uniform, kit, and equipment:—

Clothing—

Cord pantaloons.
Patties.
Spurs.
Drawers.

Equipment—

Bandolier belt for carrying ammunition.
Complete set of saddlery.

(e.) Tactics: The tactics of Mounted Infantry may be summarized as those of infantry upon an extended scale. It is evident that the development of such tactics must be in direct proportion to the influence which such factors as selected and self-reliant men, under carefully trained and capable Officers, can control results.

In its co-operation with cavalry, Mounted Infantry are able to form rallying points for their own cavalry to fall back upon, to form points of *appui* upon the field of action, be at hand to attack or hold in check an enemy's infantry, and, if necessary, to deal with an enemy's dismounted cavalry in dismounted combat.

From the organization and system which I have briefly sketched, it will be seen that a carefully trained force of selected infantry, with the highest possible powers of locomotion, has been added to the available Regular Forces of this country. The system, moreover, admits of unlimited expansion, since it would be easy to increase the quota of men to be found by each regiment, in proportion to the strength, after the mobilization of the Reserve.

The annual cost of training, clothing, and equipping the present force of Regular Mounted Infantry is, approximately, 900*l*. The provision of the horses and their forage is not included in this sum.

I will now proceed to consider the Auxiliary Force of Great Britain.

III. *The Auxiliary Forces of Great Britain.*

I wish to invite your attention to the numbers and distribution of the Auxiliary Forces available in this country upon a great national emergency or threat of invasion by a great Continental Power or combination of Powers.

<i>Militia—</i>		
Infantry	114,110	
Engineers	2,614	
Artillery	19,001	
	<hr/>	135,725
<i>Volunteers—</i>		
Infantry	196,900	
Engineers	14,393	
Artillery	48,909	
	<hr/>	260,202
<i>Cavalry and mounted troops—</i>		
Yeomanry	10,830	
Volunteer Light Horse	364	
Mounted Rifle Volunteers	61	
	<hr/>	11,255

We may assume that the Regular Army in this country possesses, or will possess, its proper complement of the three arms; but I invite your attention to the condition of the Auxiliary Forces. You have in the aggregate 395,927 infantry, engineers, and artillery, and 11,255 Yeomanry and Mounted Rifles. These totals give a percentage of 2·8 mounted men to the troops available. Now, the acknowledged proportion of cavalry or mounted troops is 10, so that you have a total force of 28,337 mounted men to raise or improvise upon the mobilization of your armies for home defence.

It may be argued that the Volunteers are not to take the field, but are to be employed on the defensive, and for holding strategical points, and that a proportion of mounted troops is inapplicable in this case. Surely, gentlemen, such an argument will hardly stand past experience in similar instances of invasion. Imagine, for example, if Napoleon the Great had succeeded in his intention, and had landed, as he nearly succeeded in doing, an army of 76,800 infantry, 11,600 cavalry, and 432 guns, upon the shores of Kent, Sussex, Hampshire, or Essex.

"If," wrote Napoleon, "Admiral Villeneuve, instead of entering Ferrol, had contented himself with joining the Spanish squadron, and instantly made sail for Brest and joined Admiral Gantheaume, my army would have embarked, and it was all over with England."

Granted that London is defended by a cordon of detached works, unassailable by an enemy's field army, still our own Regular Army, supplemented by Militia and selected brigades of Volunteers, would be barely strong enough to make a victory over our enemy possible. In case of a reverse to our field army, the defence offered by our Volunteer Forces would be paralysed, unless they were able to take the offensive and maintain, at least, the lines of food supply to the metropolis.

You will recollect how Hannibal, after destroying the legionaries and regular troops of the Romans at Trebbia and Thrasymene, maintained himself at the head of 24,000 men for fifteen years in Italy, until the wealth and power of Rome had raised an army possessed of power of mobility to crush him at Cannæ. Our credit and our commercial position would hardly admit of Fabian action of the kind adopted by the Romans. It would therefore seem that the usual proportion of mounted troops is equally essential for our auxiliary armies as for our Regular Army. This principle was certainly recognized in 1803, when more than 60,000 Yeomanry and Light Horse were raised.

Let us suppose this point conceded, and proceed to consider the necessities that would govern a campaign in this country.

We may assume that an invader would be accompanied by a picked force of cavalry, such, for instance, as the 11,600 cavalry under Murat, destined for the invasion of this country in 1803. It would be to court obvious disaster were we to oppose such troops as these by any but Regular cavalry in any country suitable to the action of this arm. Consequently, no Commander would think for one moment of opposing an invader's cavalry by the hastily raised and untrained squadrons of our Yeomanry. But the physical condition of the country between the coast and the metropolis is peculiarly unsuited to the action of cavalry. Except upon the Downs fringing the sea, and upon occasional stretches of more open country lying upon the great chalk ridge running east and west from Dorking, the country through which an invader's army would pass is difficult in the extreme; it is on all sides intersected by high banks and hedgerows, which break the whole face of the country into small fields. Large woods and

numerous streams, with frequent towns and villages all capable of defence, make any military operation difficult, and render the action of cavalry as cavalry impossible.

On the other hand, it is a part of England suited above all others to an active defence from mounted troops trained to fight on foot, or from infantry having means at their disposal of rapid locomotion. Every hedgerow, every bank, becomes a position; every village, every town, a stronghold from which infantry can alone be dislodged by infantry or by cavalry acting dismounted.

A force of mounted troops with tactics such as to utilize these physical disadvantages, and handled by a daring, dashing leader, covered by a screen of cavalry or mounted rifles, should be able to delay an enemy's advance until forced back by his infantry columns; it should further be able to operate on his flanks, and threaten his rear.

Let us consider what troops we have available for this important rôle. We may put aside our Regular cavalry, as their efforts would be confined to holding in check and operating against the enemy's cavalry, and we therefore find that we have the Yeomanry alone available for this purpose, or at least such of them as could be concentrated in or about the south-east corner of England. In a recent lecture at this Institution one of the most conspicuous of the Yeomanry Commanding Officers, an ex-Officer of long standing and experience in one of our most brilliant cavalry regiments, has declared that "shooting is not a popular part of their duty." And again, that in case of an invasion, the Yeomanry, "having been for some time under training, would be a most efficient rough-and-ready cavalry force, who would give a good account of any foe who came against them." Is it to be understood that the prevailing opinion among the Yeomanry themselves is that their regiments aspire to be considered as cavalry of the accepted European type? Do the Yeomanry squadrons consider themselves fitted to compete with the serried squadrons of highly-trained Continental cavalry under the conditions of modern European cavalry tactics?

Surely such arguments show that the necessity of a close study of the American War of 1861-65 cannot be too strongly pressed upon those who hold such views as these. The pages of the history of that extraordinary struggle, the contemporaneous accounts and biographies, teem with the most valuable lessons. Careful readers will there find, especially if they read between the lines, the unspeakable advantage to an army of having, as had the South at the outset of the war, mounted troops possessing that audacity begotten of individual daring, intelligence, and horsemanship, which enabled them to penetrate an enemy's line of outposts, to execute harassing raids upon the flanks and rear in a close and difficult country, to supply guides and scouting parties capable of directing divisions of infantry through difficult and intricate country. In the bloody pages of the early part of that war, the student will discern the hopelessness of hastily raised and imperfectly trained cavalry attaining that proficiency in their work which fits them to move in mass with the speed, unity, and precision essential to effectual action in the shock of battle which would alone

justify their being utilized against the trained and disciplined squadrons of an invader's cavalry. The student will there find that the Southern cavalry, which gained an imperishable renown at the outset of the war as Mounted Riflemen, possessed the same qualities which we now find in the ranks of our Yeomanry—men who, owning their horses, possess a knowledge of horsemanship, an eye for country, and a readiness of resource in critical moments of danger which are begotten of a natural aptitude for field sports, men who have that familiarity with firearms which makes natural marksmen.

Such are the qualities which make an invaluable force of mounted troops for the purposes for which the companies and battalions of Forrest's, Morgan's, Grierson's, and other cavalry served their leaders so well.

The Northern Army was precisely in the condition in which our Home Defence Army would be upon a threatened invasion, when Sherman summed up their position as follows: "We had good organization, good men, but no cohesion, no real discipline, no respect for authority, no real knowledge of war."

In the later phases of the war, when many long and weary months or years of hard campaigning had turned the original type of American cavalry, or more properly Mounted Rifles, into efficient and highly trained cavalry, then and then only did that cavalry combine the "fire" tactics of Mounted Rifles with the "shock" tactics of regular cavalry.

The *rôle* that a consensus of military opinion urges upon the Yeomanry is that assumed by the American cavalry at the commencement in their Great War, namely, of becoming "Mounted Rifles" according to the definition that I have given at the commencement of my lecture. It is a *rôle* distinct from that of Mounted Infantry, as to be a Mounted Infantryman a man must first be a thoroughly trained and highly efficient infantry soldier, which a Mounted Rifleman has never been and is not required to be.

If the Yeomanry force seriously decline to accept the position assigned them by the great majority of thinking soldiers and professional writers, it becomes a question whether they can take any place in the defence of the country except as scouts or orderlies. If, however, they will accept the *rôle* of Mounted Rifles, the force of Mounted Infantry such as may be well furnished by the Volunteer infantry battalions would be a most powerful and valuable adjunct to them in their dismounted action, while they on their side, with their superior horsemanship, horses, and knowledge of country, would perform all the outpost and scouting duty for their comrades of the Mounted Infantry.

IV.

I will now submit to you a few details of the scheme which would provide the Volunteer Army with a very important force of Mounted Infantry.

I have sketched already the organization of the Regular Mounted

Infantry, so that I have now to adapt its principles only to the Volunteer infantry battalions.

I propose that every Volunteer battalion should have each a complete division, viz., one Officer and thirty-two non-commissioned officers and men, and that these divisions should be tied together in four, and so form companies. The companies so formed should be comprised of divisions having a similar identity or belonging to the same territorial regiment. For example, one company might be formed by a division from each of the following, and called

"The Rifle Brigade Volunteer Mounted Infantry Company."

{ 1st Division—7th Middlesex, London Scottish.			
2nd	"	13th	" Inns of Court.
3rd	"	15th	" Custom House.
4th	"	16th	" London Irish.

Or in the case of a Volunteer Brigade, as, for example, "The Tyne and Tees Brigade," the Mounted Infantry companies would be organized as follows:—

"The Northumberland Fusiliers Volunteer Mounted Infantry Company."

{ 1st Division—1st Vol. Battalion Northumberland Fusiliers.			
2nd	"	2nd	" " " "
3rd	"	3rd	" " " "
4th	"	1st	" Durham Lt. Infantry (attached).

"The Durham Light Infantry Volunteer Mounted Infantry Company."

{ 1st Division 2nd Vol. Battalion Durham Light Infantry.			
2nd	"	3rd	" " " "
3rd	"	4th	" " " "
4th	"	5th	" " " "

In order to make the detail of each proposed company clear, the same organization as that adopted in the Regular Mounted Infantry companies is here repeated, thus:—

Tyne and Tees Volunteer Brigade.
Detail of No. 2 "Durham Light Infantry" Volunteer Mounted Infantry Company (Field Army Table, p. 146.)

Detail of a Company in the field.	I Division. 2nd Vol. Battn. Durham Light Infantry.	II Division. 3rd Vol. Battn. Durham Light Infantry.	III Division. 4th Vol. Battn. Durham Light Infantry.	IV Division. 5th Vol. Battn. Durham Light Infantry.	Grand Total.	Remarks.
Major or Captain.....	1	—	—	—	1	
Lieutenants	4	1	1	1	4	
Company Sergeant-Major.....	1	—	—	—	1	
Sergeants	5	1	2	1	5	
Corporals	6	1	1	2	6	
Sergeant-drivers	2	—	—	—	2	
Shoeing-smiths.....	2	1	—	—	2	
Baggers	2	—	—	—	2	
Privates	99	25	25	24	99	
Dismounted men, servants, &c.	5	2	1	1	5	
Cooks and wagonmen...	5	1	1	2	5	
Saddler	1	—	1	—	1	
Total	133	32	33	33	133	

Upon this principle 52 companies might be formed from the 208 infantry battalions.

These Mounted Infantry divisions should be composed only of Volunteers who are good shots, thoroughly drilled as infantry, and who have some knowledge of horses. Men so selected should be further trained in the simple drill laid down in the Mounted Infantry Regulations, and should be rendezvoused by companies for four days' training mounted, every two years.

Those of us who are most experienced in this particular service lay but little stress upon the difficulty of riding. Riding is always found a very easy matter to teach to good infantry soldiers. The primary and real difficulty has always been to inculcate the principles of organization necessary, and to establish the lines upon which the Mounted Infantry work is to be carried out.

I estimate that an extra grant of 1*l.* per annum per Mounted Infantryman would provide sufficient funds for the mounted division and for hiring horses for four days' training biennially.

Thus, 208 battalions, each one division = 52 companies = 6,864 Mounted Infantrymen.

Total cost at 1*l.* per head = 6,864*l.* per annum.

The funds available for each Mounted Infantry soldier would, therefore, be

	£	s.	d.
Present capitation grant per man per annum ...	1	15	0
Add capitation grant per Mounted Infantryman for extra clothing.....	0	6	0
Add for half cost of hiring horses for biennial training per annum	0	14	0
Total.....	2	15	0

Twenty-five small horses per Division, say of 15 hands, would be sufficient for each biennial training, allowing for a certain proportion of non-effectives, for which purpose there would be available $33 \times 14s. \times 2 = 46l. 4s.$, or 1*l.* 17*s.* per horse, or 9*s.* 3*d.* per day per horse, which is rather above the average paid by Artillery Volunteer Corps for their draught and riding horses.

The saddlery might be lent from the Government stores for the short period of training.

The system advocated has the merit of being one which is capable of expansion to an almost unlimited extent, as it would not be difficult for a strong Volunteer battalion to find a half-company of sixty-six men and Officers in place of a fourth of a company as now proposed.

Such is the force of Mounted Infantry which I propose for your consideration.

Each of the fifty-two companies will be, as I have shown in the case of the Regulars, complete in itself, so that companies could be combined together into battalions, as necessitated by the scheme for the defence of this country. In this manner, and in this manner

only, can any system of Mounted Infantry be reckoned upon as a factor in the available resources of the country. The present fragmentary condition of the Mounted Infantry organization among certain Volunteer battalions renders it impossible to deal with Volunteer Mounted Infantry as a force of which advantage could be taken on a national emergency. It is, however, very obvious that to organize a force such as I have described, and to instruct it in its duties, it will be necessary to establish an Instructional School, which should not only instruct Volunteer Officers and non-commissioned officers in their duties by a special course of instruction, but should provide an Inspecting Officer and qualified Officers to assist during the biennial training of the Volunteer companies.

It would be unwise, however, in dealing with this interesting and important subject, to omit reference to the one weak point in this question—a weakness which, common to the whole Volunteer Force, is more conspicuous in the present instance, dealing as it does with a force intended for special and critical duties before the enemy. I allude to the unprofessional character of the Officers and their want of professional knowledge and experience.

Gentlemen, it requires, I venture to think, the experience of at least one campaign, to make the necessity of having Officers of a high calibre obvious. I am very sure that men who are not by profession soldiers cannot realize in peace time what the want of highly trained and professional men as Officers really entails in war. It is a fact well known to all students of war, that the more intelligent and better educated the soldier, the better in degree must be the Officer.

Nothing is more true than the fact, as stated by a recent writer, that "To lead men in battle is a profession demanding careful education and thorough training." A knowledge of drill and the possession of intelligence and zeal sufficient to pass the standard of a professional examination, are *not* the only qualifications which make subordinates rely upon the dictates of their superiors in military rank upon moments of danger.

It has been said by one of their own leading Generals, in referring to the discipline of the newly-raised Armies of the Federals in 1861, that "the men resented obedience to those who were superior neither in social standing nor professional knowledge to themselves." The moral discipline of one man over another, when everyone's life lies in the palm of his hand, depends not upon such veneer as the rank which gold lace or an embroidered cuff might indicate, but stands upon the rooted conviction or instinct of the subordinate that the superior possesses the superior knowledge and the habit of command, begotten of long practice and experience. Then and then only will exist that real discipline which wins battles and makes troops invincible.

This is the great weakness, the great blot, in our Volunteer system and organization, and the command of a company of Mounted Infantry is a position which requires a Captain of such knowledge and professional attainments as can hardly be found among unprofessional men, no matter how able or how conversant with their

theoretical duties. The only plan to compensate for this want seems to be that specially appointed Officers should be named for the responsible command of the Mounted Infantry companies and battalions. Officers of the Reserve, or Officers who have retired from the Service, should be found who would undertake the duty.

Conclusion.

Gentlemen, in the paper which I have read to you, it has been my endeavour to submit for your consideration and thought the experience gained during ten years' study of this particular subject. A fellow feeling towards the promoters of this Volunteer Mounted Infantry movement has prompted me to submit the deductions drawn from practical experience of the value of Mounted Infantry, and of the facility with which they can be raised, organized, and placed in the field.

It is the aim of this paper to pave the way to a further development of a movement which the Earl of Mount-Edgcumbe, Lord Wantage, and many other Commanders of Volunteer battalions have already initiated.

No man can say when the vast military resources of the Empire may not be put to the test by a struggle for our very existence. The unselfish, painstaking, loyal efforts of the Volunteer Force of this country may at any moment be strained to the utmost, and if this paper has shown one additional means by which the efficiency of our great Volunteer Army can be increased, the object of the writer has been amply fulfilled.

Colonel the Hon. H. CRICHTON, Commanding Hants Yeomanry: I suppose the honour has fallen upon me of speaking first, because I was mentioned in the lecture. I have, I am afraid, to take exception rather to the sentence which has been quoted from my lecture given here a month ago; Colonel Hutton speaks of me as saying that "shooting is not a popular part of the duty of the Yeomanry." Of course that sentence does not explain itself completely unless taken with the context, and looks as if I and the Yeomanry as a body were averse to shooting. I, therefore, beg leave to read the whole sentence, as I read it, and as it appears in the Journal of this Institution: "The next most important thing to riding is shooting, and this, I regret to hear, is not a very popular part of their duty; and, as it is so important, I consider that if the permanent duty time was prolonged, as I am suggesting, it should be done during that time, and so become one of the paid drills, and a qualification of the efficiency grant, or a fine for absence from it. It is impossible to carry out the musketry properly, except at permanent duty." The context will, I hope, show that I am well aware of the importance of musketry. I maintain, as a rule, that in musketry we are misrepresented in the Yeomanry, as we are in many other things. I would like to say a word or two about musketry. I believe it is not in many cases a very popular part of their duty, and there is cause for it. Musketry has been an affair of recent days in the Yeomanry. It is only within the last two or three years that they have had a regular musketry course, the Yeomanry only get forty rounds of ammunition to fire in the year, whereas the Volunteers get sixty rounds, and if they want to fire any more they have to pay for it. Now the Yeomanry have not got the custom of going round the country, and asking for subscriptions towards their rifle clubs. Perhaps it would be better for them if they did. I do not see why the country should not pay for ammunition for the use of

their regiments. The Officers of the Yeomanry are trying to make musketry popular; they give cups, they offer prizes out of their own pockets, and they do everything they can to encourage the Yeomanry to take to shooting. Another thing that I should advocate in the organization of the Yeomanry is that musketry should be made part of the regular drill necessary in order to get the efficiency grant. I believe that that would turn out of the Force a great many men who are useless, and it would give more money for those who remain. The next thing in which I am quoted by the lecturer is this, that in case of an invasion the Yeomanry "having been for some time under training would be a most efficient rough-and-ready cavalry force, who would give a good account of any foe who came against them." I will again refer to my lecture, and read exactly what I said: "It would also be required in case our forces abroad met with a reverse, and the enemy turned the tide of war toward our shores," by that time, the Yeomanry having been for some time under training, &c., if our forces met with a reverse it would surely take a month or two before they did so, and in that month or two I maintain if our Yeomanry had been under training they would be an efficient force, and would be able to meet and meet satisfactorily any foreign foe that came to our shores. The way that Yeomanry are often seen is without any previous training, when I dare say they do often look ridiculous; but if in fourteen days' time they can do, as our inspectors sometimes say, "wonders," what would they be able to do in two months' time? Individually they are men who are trained from their early boyhood to riding, which no one can say cavalry soldiers at home or abroad are; and after two months' training they would be equal to meet foreign cavalry, who are bad riders as a rule, and who have not a very high training; and would form the only reserve to our cavalry which exists. Colonel Hutton says: "The rôle that a consensus of military opinion urges upon the Yeomanry is that assumed by the American cavalry in their Great War, namely, of becoming 'Mounted Rifles,' according to the definition that I have given at the commencement of my lecture." I will turn now to the commencement of the lecture, where he says, "Mounted Rifles, on the other hand, are best defined as horsemen trained to fight on foot, men who are mounted and intended to perform all the duties of cavalry, except that which may best be described as 'the shock.'" I should like to ask the lecturer whether by that he means that the Mounted Rifles would never be able to meet a charge of any mounted troops?

Colonel HUTTON: Yes.

Colonel CRICHTON: Then I must refer him to the experiences of the American war, and I quote from the history of the army of the Cumberland, "Wilson's Cavalry Operations," p. 350: "At this juncture Long ordered forward four companies of the 17th Indiana, Lieutenant-Colonel White commanding, with drawn sabres. These companies drove the enemy to his works, dashed against his main line, broke through it, rode over his guns, and finally turning to the left, cut their way out." To return to the lecture, Colonel Hutton says: "It is expected of them that they should perform all the outpost, reconnoitring, and patrolling of an army in a manner similar to cavalry; the only difference being that they must rely solely upon their fire powers for defensive and offensive actions." I should like to ask if by that he means that the Yeomanry ought not to have swords?

Colonel HUTTON: That is quite a matter of detail. The firing weapon is the offensive weapon, whether rifle or pistol or revolver. I think, perhaps, the better plan would be to answer the whole of these queries presently.

Colonel CRICHTON: I shall be glad if you will answer that at the end—"the only difference being that they must rely solely upon their firing powers for defensive and offensive action." If we are supposed to perform all the duties of cavalry I consider we should be at a very great disadvantage if we were to meet opposing cavalry, and had to meet them without swords. In his lecture Colonel Hutton goes on to say that the consensus of military opinion of thinking soldiers and professional writers is that we should accept the rôle of Mounted Rifles. We have no objection whatsoever to working on foot. It seems to be thought that we have an objection to doing it, but there is no such feeling at all events in my regiment. We do work a great deal on foot, and I wish that those military men who do think and who do write about military subjects would only come down a little more to see us, for I

am sure they would then form better opinions about the Yeomanry than they hold at this present moment.¹

General KEITH FRASER, C.M.G. : Lord Hardinge and gentlemen, I should not have ventured to send my name up to take part in this discussion after what Colonel Hutton has said, viz., "that his lecture was intended entirely for the Auxiliary Forces,"² had I not felt that he referred a good deal to matters connected with the Army. Besides being Inspector-General of Cavalry, I have the honour to be Inspector of the Auxiliary Cavalry, and in that capacity I have had considerable experience, as regards the Yeomanry, within the last few weeks. Many years ago I was also an Inspector of Yeomanry, and I therefore know a good deal about that force, both in former days and at the present time. I may therefore be excused, I hope, for saying a few words. I myself, personally, as I said once before on the occasion of a previous lecture given by Colonel Hutton, in Dublin, have no feeling of jealousy towards the Mounted Infantry. If I thought they were good, I should advocate most strongly the employment of Mounted Infantry. I have lived a great deal abroad, and what active service I have seen has been, generally speaking, with foreign armies, and I have had the opportunity of knowing a great many of the most distinguished men in the armies of Europe and of America; and I have found that the consensus of military opinion throughout the whole of the civilized world, with the exception of this country, is contrary to the use of mounted infantry. It is only in England that you hear of them at all. An American Officer of great distinction said to me the other day, "There is not an Officer in America, either in the cavalry or infantry, who would accept the term of 'Mounted Infantry.'" They have never acknowledged that they have Mounted Infantry. An infantry Officer and an infantry man is very proud of his calling, and he sticks to it and makes the best he can of it, and he is quite right in doing so. And with cavalry Officers and men it is the same. The word "mounted infantry" is not used. There are no people more hostile to Mounted Infantry than the American Officers. That, however, has nothing to do with what is before us. Mounted infantry have been accepted in England, possibly owing to our more *advanced* views, or—as some people may call them—fads. Colonel Hutton has said that our political history shows that "no Government will ever vote supplies for any innovations upon existing institutions, until they have been demanded through the public Press." Now, I am quite sure that the cavalry wish for many things that they have not got. We think much more might be done for us, but still, as a cavalry Officer and an Officer of the Army, I may say we do not make our grievances known through the Press. We do not try to advertise ourselves, or to push our branch of the Service much before the public. Though there are many things that we would be glad to have done for us, still we consider that we are bound to obey, and to assume that whatever those who are put in authority over us say is right, whether we agree with them or not; we obey their directions, and carry them out as well as we can. With regard to "Mounted Infantry" and "Mounted Rifles," I must say that I feel like Lord Wolseley, in Dublin, that he could not realize the distinction between them. I have felt the same thing. I only hope that we are not going to have a third mounted corps. We have enough already. I think our cavalry are both Mounted Infantry and Mounted Rifles. They ought to fulfil both functions. If they cannot, the sooner they are done away with the better. I believe it is the universal opinion of military men in Europe and America (though it is most extraordinary that it seems not to have reached everybody's mind in England), that cavalry must dismount when necessary. I have never seen a cavalry Officer who has disagreed with this principle. I am very glad that Colonel Hutton referred to

¹ Colonel Hutton did not answer my question in his summing up, as to whether he recommended the abolition of swords. The Yeomanry, in my opinion, would be pleased to accept the rôle of the American cavalry, but if they do so they must surely be allowed to use the same weapons and to be trained to charge in the way which the American cavalry did, to enable them to meet other cavalry without being placed at a very great disadvantage.—H. G. C.

² Statement in some introductory remarks by Colonel Hutton.—Ed.

his system of drill and organization, and also to think that the Mounted Infantry have succeeded in getting what we have tried for thirty years in the cavalry to get, even before Colonel Baker's day. We, many of us, have always tried to get it, and I hope that the system which has been existing all over Europe for more than a quarter of a century will at last be carried out with us. I am very thankful that the Mounted Infantry have been able to accomplish it, and I hope now that it has been brought forward so much, it will be adopted in the cavalry generally. I do not think myself, with regard to Mounted Infantry, that the best mode of transporting them would be upon horses. I should have thought that if you wanted to send a detachment of infantry very quickly from one place to another, where good roads exist, the better way would be to send them on wheels. I am sure that the vans and carts, &c., that you have in London would be very much better for the transport of infantry than horses, especially for men who do not know much about horses, although Colonel Hutton appears to think that in a very short time a man can learn to ride and understand all about saddlery, management of horses, and all that kind of thing. I think the infantry could be very much better carried on wheels, and they would shoot better when they got to their journey's end than if they had been riding on horseback with an 11-lb. rifle in their right hands. With regard to the Yeomanry, as to shooting, I concur in all that Colonel Crichton has said. Every Officer of that Force that I have spoken to on the subject has been most anxious to carry out good shooting. They have always said, "Our men are most anxious to shoot." I have myself always, when inspecting them, seen them do dismounted work, and they do it generally very well indeed. I am quite sure that, with a little encouragement, they would take up shooting as heartily as the Volunteers have done. And you must remember, in addition, that they are mounted, and provide their own horses without expense to the public. I was very glad to hear Colonel Crichton's remarks with regard to the American Army. I happen to know a great deal about those American campaigns, and I only wish people would take his advice, and study them. Those campaigns inspired in England the extraordinary idea that the American cavalry on both sides was only Mounted Infantry. Now the fact is, that in the Northern Army there were at one time as many as 80,000 cavalry, commanded by regular cavalry soldiers, who had been educated at West Point. No mounted man carried a rifle in the army of the Potomac. The lecturer referred to Forrest, Morgan, and Moseley, who were partisan Generals of irregulars, and he mixed up the name of Stuart with theirs. Now Stuart was a purely cavalry General; Sheridan, "Cavalry Sheridan," as he was called by his men, too, was brought up at West Point; and there were Kirkpatrick, Custer, Gregg, Merritt, Pleasanton, and others, all regular cavalry soldiers. It was said the other day, by Lord Wolseley, "If you read Denison you read the evidence of an impartial man, who is not carried away by his imagination." Well, I have read Denison again and again, and I have found in his books numerous descriptions of great charges of cavalry. Instead of taking it for granted that the American cavalry was Mounted Infantry, and therefore could not charge, I would recommend you to read the various histories written of the American War, such as Denison's, Von Boreke's, Gilmore's, Stuart's Life, &c. I find that the Comte de Paris, in his invaluable work "*La Guerre Civile*," describes, in page after page, combats of large bodies "*à l'arme blanche*." Take, as an example, the fights at Brandy Station, where "*la cavalerie Fédérale est allée en masse attaquer celle de l'ennemi. Les deux troupes se sont livrées un véritable bataille rangée, où l'infanterie et l'artillerie n'ont joué qu'un rôle insignifiant. Le sabre a fait un grand nombre de victimes.*" That is a stray quotation I casually picked out this afternoon on my way here. I think the history of the American War shows plainly that cavalry, when necessary, acted dismounted, and it also shows that they were always ready to take part in a charge, and to act mounted as long as possible. One word as to riding. I do not think it is so easy to teach infantrymen to ride as the lecturer seems to think. Colonel Crichton said that foreign cavalry do not ride well. I cannot let that pass. The Austrian and Hungarian cavalry, to my knowledge, do ride extremely well, and I feel bound to speak up for them. I should be content to see our cavalry ride as well as the Austrians and Hungarians, at all events.

Colonel the EARL OF MOUNT-EDGECUMBE, A.D.C., 2nd V.B. Devon Regt. : I can add very little to this discussion, but, as the lecturer has spoken of paving the way to the further development of a movement which I and others have tried to initiate in raising Mounted Infantry Volunteers in connection with Volunteer battalions, I think it is only right to say that the company attached to my own battalion hardly was raised upon the basis of Mounted Infantry, as described in his paper, that is, upon the basis of attempting to teach men drill and tactics as Mounted Infantry, and letting them see their horses only four days in two years. I was rather surprised to hear that Colonel Hutton thinks that is possible. Our men certainly come more under the definition of Mounted Rifles, as described in his paper, that is to say, they are horse-men taught to fight on foot. It is necessary they should be so, because, as they have their horses all the year round, and we have no means of supplying them with horses, only those can join a company of this kind who have horses of their own, and, of course, they are riding men who chiefly take an interest in the riding part of their work. At the same time I do think they would be found efficient in what is required, according to Colonel Hutton's idea, as Mounted Infantry; they are not cavalry; they are not allowed to carry swords by regulation, and I think they are efficient on this account. The Officer who now commands this division, and also the Instructor, went to Aldershot, as Colonel Hutton knows, to go through a course with the regiment, and when they came back they assured me that the drill and tactics we have adopted are in strict conformity with those adopted at Aldershot by the Mounted Infantry Regiment, and I think if they were sent to take part with other companies in a battalion they would be found efficient as Mounted Infantry. But there certainly are two disadvantages in the system we have adopted; first, that as these men must be enlisted from those who are sportsmen, riding men, they naturally would compete very much with the Yeomanry. I suppose there is no part of Devonshire, except that close to Plymouth, where such a company could have been raised at all, and I have no doubt the Yeomanry might very easily do all that is required of Mounted Infantry. You might get the Volunteers to take an interest in Mounted Infantry work on the basis proposed by Colonel Hutton, but I should hardly think it possible to teach them the drill and tactics without letting them see their horses except for four days in two years. I dare say a very little would make a man stick on his pony, but it would take a good deal to make him know how to look after his horse and saddlery. I do think it might be possible to get a certain number of men in a large battalion of Volunteers to take an interest in that work, if you were able to hire horses for them during the week for which most of the men now come out in camp. I do not think it could be done in a battalion, where we have a different organization in force, but possibly it might be done elsewhere. The other objection to the system we have, is that there are only a small number of men in a battalion who would have the horses and be able to join, and it is difficult to keep up that number; and when they go out, as they often do in Plymouth, with the garrison for a field day, the numbers are so small that they are almost invariably used simply as scouts, patrols, or orderlies, and, therefore, they do not get much practice in that work which Colonel Hutton wishes them to do. I heard some one say that the Mounted Infantry ought to have swords. There may be objections to that, but at the same time, if the men are acting as scouts and patrols in a close country like Devonshire, where two or three men, or a half-dozen men, may come in contact with a small number of men who have swords, I think they ought to have some means of individual defence, which I think ought to be a revolver. Otherwise two men with sabres coming across half-a-dozen men without, would be like a couple of dogs among sheep, and the other men would have no chance. I have not had an opportunity of thinking sufficiently over this subject, but I believe it might be possible to get the Volunteers to take up the system recommended by Colonel Hutton.

Colonel WOOD, C.B., late 10th Hussars : The time is very short, and I will only refer to one or two subjects. I must, however, take exception first to the statement made in the commencement of the gallant Colonel's lecture, in which he says, "This country has therefore a picked force of infantry marksmen who have been trained, equipped, and organized in such a manner that they can be given any means of rapid locomotion which is

best suited for the service for which they may be required." I take exception to that word "marksmen." I have privately spoken to the gallant Officer on that subject, and he has told me that he does not want marksmen, that they are not the sort of men wanted for mounted infantry. (Colonel HUTTON: No, no.) Perhaps he misunderstood me at the time, but this paragraph will go to the public as showing that there are a certain number of trained *marksmen*. I should think there are very few. I would even go so far as to say that out of these 1,750 men, they are not many of them even first class shots. I also could say, much as he cries down the shooting of the Yeomanry (of which I have now had experience for nearly six years), that I am quite certain I could pick out from the Yeomanry quite as good shots as these 1,750 men who compose the Mounted Infantry. The next thing I object to is his term "hastily raised and untrained squadrons of Yeomanry." Surely, this is unfair to that force. These men train every year for a longer time than Volunteers do. ("No, no.") They do, indeed; their days of drill are, man for man, more than those of the Volunteers. Deducting all their recruits, and making allowance for sick men and different casualties, 5,000 Yeomanry could be transported in forty-eight hours to any part of England, men riding their own horses and efficient in every kind of way. That force certainly, within fourteen days, could be increased to 10,000; and when I tell you that nearly 30 per cent. of the Yeomanry Force are recruits, it will show you how many men are passing through the Yeomanry year by year. In less than a month's time most of those men would gladly drop back to their old regiments, bringing with them all the horses they could possibly bring, and these men would form a most valuable reserve of Yeomanry of which the public are perfectly ignorant. Then again, may I ask what earthly use can men be who are trained (as the gallant lecturer proposes to train his Mounted Volunteers) for four days only every two years? These may be men who are fond of riding, but when you admit that even ten days' training a year is considered the least that can be given to make Yeomanry effective, is it likely that we can have an effective force who have only four days' training every two years? With regard to the Yeomanry shooting, Colonel Crichton says it is only three years since they took up shooting. I am sorry for that, because I think I spoke to him about his shooting nearly six years ago; but, anyhow, for the last three years there has been a very great increase in proficiency in shooting amongst the Yeomanry. I see before me representatives of three different regiments who every year send men to compete for the Loyd-Lindsay Prize, and the shooting and the riding of those men has often been favourably commented on. It is quite true it has not been for want of representation that the course of musketry prescribed for the Yeomanry has not been much increased. I felt it my duty year after year, during the time I held office as Inspector of Auxiliary Cavalry, to represent that they should have a different kind of instruction from what had been already laid down. I think still it might be improved. I think the distances they give them to shoot at are too short; they ought to shoot up to 500 or 600 yards, and their prizes should be given more for volley than individual firing. The lecturer assumes that Yeomanry could be no use at all working about an enclosed country. May I ask if anybody here present can tell me what has ever been the effect of the charge of determined men, well led, and gallant men riding resolutely home—as we know our Yeomanry would do—down a road or a defile? What effect would they have on any column advancing through those deep lanes in Kent or Sussex, or anywhere else? It is perfectly true a few of them would be shot, but the majority of them would get home unless there was ground on which the infantry could deploy and outflank them. It can hardly be said that Yeomanry who were determined to sacrifice themselves would not paralyse the advance of any infantry for a considerable time. I think I have now touched upon the points I wished to notice, except one. Our gallant lecturer always takes us back to ancient history, and his powers of research are very great; but it is amusing to me to think of Hannibal sitting quietly chuckling to himself in Italy for fifteen years because there was no Mounted Infantry to turn him out.

Major WALTER LONG, M.P.: I must apologize for taking any part in this discussion. My only reason for doing so is that I have been connected with the VOL. XXXV.

Yeomanry for seventeen years, and have taken the greatest possible interest in its existence. I have always felt myself that there are only two courses open to this Force: one is, that they should be made more efficient than they are at the present time, and the other is that they should be abolished. It seems to me that the suggestion of the gallant lecturer, that they should be turned into Mounted Infantry, is not one which carries with it any recommendation from the point of view of general utility. If they are to be altered, I would venture to submit that they should be altered in the direction of being made more efficient than they are at the present time. I gratefully acknowledge that we have heard from those distinguished Regular Officers who have had practical experience of Yeomanry during the last eight years that they have vastly improved during that time, and I can say from my own experience that the Yeomanry of to-day are as different from the Yeomanry of seventeen years ago as it is possible to imagine the same force to be. They have devoted themselves during that seventeen years to learning their duty, both Officers and men. I believe now in all Yeomanry regiments in this country there are to be found Officers, from the Colonel down to the latest-joined Subaltern, who know how to perform their duty in the field, to lead their men, and who only ask one thing of their fellow-countrymen, and that is, that they shall be induced to become more efficient, and that there shall be a fair consideration paid to their maintenance as a volunteer Force. This question has an interest for soldiers. I believe at the present time there is every necessity for strengthening the popularity of the British Army in this country, and for making as many friends as you possibly can in our arm of the Service, and conferring every possible advantage upon them. And if you put an end to this branch of the Auxiliary Forces, which gives an opening to many men who are valuable as soldiers, but who are unable to take part in regular soldiering, you will be putting your foot heavily down on those men who are constantly working quietly in support of the British Army, and in support of the British Army being liberally treated by the nation. If you injure the Yeomanry you injure the Army by depriving it of its friends, and by doing so you get rid of that feeling in this country which alone has enabled it to maintain a great volunteer army, namely, the natural inclination on the part of every Englishman to take some part, great or small, in the defence of his country. I must apologize for taking any part in this discussion, but I do say this: You may ask of us any question you like; you may insist upon our knowing more and more every year about shooting and all these things; but if we are to be better shots, give us the opportunity by affording us better facilities for obtaining ammunition, and give us more facilities for getting ranges, where local owners cannot help us. Ask us to become better shots, and I believe we will do it, if we are given the opportunity; do anything you like in the direction of making the Yeomanry Force more efficient than they are at the present time; but I would pray those who are interested in the Army, and who are anxious to see the defences of this country better than they are at the present time, not to do anything which might have as its result the destruction of one of the oldest and most constitutional Forces of this country, and which would, I believe, not result in making the defensive forces of this country greater or better than those at the present time.

Colonel ALT, 22nd (Central London Rangers) R.V.: I think it is time that an infantry Officer rose to take part in this discussion. I therefore do so on behalf of the branch of the Service which I represent. I agree with almost every speaker to whom we have had the pleasure of listening, but they have spoken rather wide of the mark, having confined themselves to replying to the lecturer's criticisms of the Yeomanry. They have been rather rough upon him, and he has been severely handled by some cavalry Officers. I think that the Volunteer infantry forces are very much indebted to him for calling attention to the subject of his paper, and I thank him for doing so. I say that I agree generally with what previous speakers have said, for the following reasons. Why was it that the Volunteer Force came into existence? It was because the country had not got soldiers enough; it had not got material enough in its Army for national defence, and it seemed necessary to the thinking public that citizens possessing the military spirit should do something to remedy the defect, and the Force upon which so great a value is now set, came into existence.

Why is there at the present time a movement in the direction of establishing Mounted Infantry? It is because we are *short of cavalry*, and that is the secret of the whole matter. I therefore join previous speakers in deploring any attempt to interfere with the rôle of our Yeomanry, or to check the legitimate aspirations of the members of that Force to perfect themselves as cavalrymen proper, and I agree with every word that has been said in their behalf. I think they will certainly, after a few weeks' embodiment for active service, be able to hold their own against any foreign cavalry which may reach these shores, and for them to be required, after performing their proper functions of scouting and screening, to drop their sabres and retire behind mounted riflemen, would be a great mistake. I do not agree with General Keith Fraser, that questions affecting the cavalry should not be publicly agitated. It may be true that his branch of the Service have hitherto hidden their light under a bushel, and they may continue to do so, but until public attention is called to the weak points in Army organization, nothing will be done to remedy them. I have no doubt there are Officers here who agree with me that it is time something was done for the cavalry, and if nothing else comes of this discussion than that public attention is called to our lamentable deficiency in that branch of the Service, I think the lecturer will have done a very great deal of good. I have not been able to study the paper before coming here, but there are one or two points that I would like briefly to touch upon. I do not think you will be able to make men ride in four days' training in two years, or that you will be able to get horses at the price the lecturer has mentioned. Then with regard to the officering of the proposed Force, I do not at all hold with the concluding remarks of the lecturer, that Officers of the Army Reserve or Regular Forces should be nominated to command Volunteer Mounted Infantry, or mounted riflemen. I think Officers can be found amongst the Volunteers, and if you will first train those Officers, if you will only give sufficient encouragement to our Officers to get thoroughly trained, you will be able to find Volunteer Officers fully capable to train Volunteer infantry, and to lead them effectively in war.

Colonel A. R. SAVILE, 26th Middlesex R.V. : I ventured to send up my name to take part in this discussion, because I thought it was time a Volunteer Commanding Officer should speak, and that the lecturer would like to know the views of Volunteer Commanding Officers upon this question. Another reason I had was that I believe I am the only Commanding Officer of a permanently embodied Mounted Infantry regiment—the only one, I think, in the Volunteer Force or in the Regular Army. Mounted Infantry have been alluded to as existing in the Regular Army—65 Officers and 1,700 men—but I think these men are also counted as infantry in the Army, and are not permanently embodied as Mounted Infantry; and in the schedule of the different arms of the Auxiliary Forces I see no Mounted Infantry mentioned. My corps is—as probably all my Volunteer friends know—rather an exceptional corps—Mounted Infantry mounted upon wheels. It is a corps which Colonel Hutton has not thought fit to allude to in this paper at all; but I must remind you that, three years ago, almost to a day, when I was lecturing in this theatre on Mounted Infantry, Lord Wolseley was in the chair, and he said, "It is impossible to dissociate cyclists from Mounted Infantry." I notice that Colonel Hutton says, "The system of Mounted Infantry proposed for the Volunteers has not yet got beyond an embryo stage," and that shows me that he has evidently not taken the branch of the Service to which I belong into consideration, because we have got very far beyond the embryo stage. We have an authorized establishment of over 200 Officers and over 5,000 cyclists. Of course that is only a makeshift until we have Mounted Infantry mounted upon horses, or, perhaps I should say, that after we have as many men as we can procure mounted upon horses, and can afford to pay for, the cyclists can be added to them, and, perhaps, be useful. But I take exception entirely to the statements which follow, as applied to the cyclist forces, saying they "can only be looked upon as isolated fragments and disconnected atoms, and are, upon their present footing, inappreciable and useless factors in the general scheme for the defence of this country, from the need of any proper system of organization or training." I beg to say, with regard to my own branch of Mounted Infantry, the system of training was thought out two years ago, by a War Office Committee, approved by his Royal Highness, issued

to all concerned, and all cyclist sections are trained upon identically the same system. We are also indebted to Major Balfour, of the London Scottish, who has drawn up a system of drill for cyclists, so that they are all drilled upon the same system. We take every opportunity of training together. To-morrow I expect to have a number of cyclist sections under my command, to exercise in Mounted Infantry duties. I think, therefore, that those expressions hardly apply to us any more than does the expression, "depressing attitude." We have no "depressing attitude" to encounter; we have received encouragement from everybody, and our situation is most exhilarating instead of depressing. We are getting on excellently. With regard to the education of Officers for the command of Mounted Infantry troops, that, I think, is a question for the authorities to decide, and I fully believe that whatever standard the authorities like to lay down as the proper standard of knowledge for a Captain of Mounted Infantry, the Volunteer Officers will rise to that standard, if they are given opportunities to do so. As to the Captains of my own corps I feel sure that they will do so, and if my twenty-five years of service in the Regular Army and my Staff College Certificate is not sufficient, I shall be only too glad to go through any other course of training which may fit me to be a Commanding Officer of Mounted Infantry. As the cyclists are the authorized Mounted Infantry branch, at present, of the Volunteer Service, I am sorry that they were not more mentioned in this lecture. I see there are but two words which may be applied to us. After mentioning various means of locomotion we find the words "mechanical contrivances:" that might mean balloons or steam-rollers, or anything. I conclude it means bicycles. One word more and I have done. I see Colonel Hutton says the Mounted Infantry of the Regular Forces are provided with the highest possible means of locomotion: that again makes me think he had not the cyclists in his mind. I do not know what proportion his means of locomotion bears to ours—Lord Wolseley said at my lecture that the Mounted Infantry could move 30 or 40 miles at a pinch. I should be very glad to move 100 miles without any inconvenience, or a still greater distance at a pinch. I feel sure Colonel Hutton will tell me later on why it is he ignored an established and organized branch of Mounted Infantry in the Volunteer Forces, which, at present, I am quite content to say is a makeshift for the Mounted Infantry on horses. But, my lord, the question of expense is one which every Volunteer Commanding Officer appreciates. During the short time I have been a Commanding Officer of Volunteers, the question of *£ s. d.* has presented itself to me, infinitely more forcibly than it ever did during the twenty-five years I was in the Army, and it seems doubtful whether we shall ever be able to afford to maintain sufficient Mounted Infantry on horses. The questions of the provision of saddlery and of horses are matters upon which other Commanding Officers will be able to speak better than I can.

THE EARL OF AILIE, Brevet-Major, 10th Hussars: I am desirous to be excused for rising to address so distinguished an audience on this matter. My excuse must be that I have had some experience of Mounted Infantry. I have known Mounted Infantrymen and Officers in various countries and places, and have been greatly interested in watching the development of opinions in the force. When we were in Egypt, during the Nile expedition, the Mounted Infantry Camel Regiment was very naturally elated at the great success of their shooting at Abu Klea and Metameh, and they used to tell us, myself among others, that Mounted Infantry could do everything that cavalry could do, certainly as well if not a great deal better. I afterwards had the pleasure of meeting the distinguished Officer who has given us the lecture to-day, at the cavalry manoeuvres on the Berkshire downs, and hearing from his lips that he considered that he had been put in a false position because he had no cavalry to escort him. These are different ways of looking at the same thing. Colonel Hutton has told us our Auxiliary Army is very much in need of mounted men, and this we all very well know; but what mounted men does Colonel Hutton propose to give us to make up the deficiency which is so evident? He does not propose to give us more cavalry or even "Mounted Rifles," who, according to his definition, would, at least, furnish us with useful men who would be able to perform some of the most important duties of cavalry, that is to be "the eyes and ears of the Army." He does not propose to furnish us with these sort of men at all, but with Mounted Infantry, who according to his own showing are not able

to scout, are not able to do reconnoitring or outpost duty, but are simply to be moved from place to place, and he proposes to spend time and money on the training of these men with horses, to use them in a country where, if anywhere, you could move men on wheels, namely, in England. Of course the more mobile your force the better. *Cela va sans dire*, but as regards our Auxiliary Forces, what we chiefly require is cavalry, or in default of cavalry such "Mounted Rifles" as Colonel Hutton has told us about. As regards the Yeomanry I need not say much; they have been very ably defended by different Officers; but it seems to me that cavalry in an enclosed country, whatever cavalry they are, must perform the rôle of "Mounted Rifles," which Colonel Hutton has described, and it seems to me that the Yeomanry will be able to fall into that rôle just as well as anybody else, if they ever have to do work in an enclosed country. As regards the arm that they carry I believe it is a question with very many distinguished Officers as to whether "Mounted Rifles," such as Colonel Hutton describes, would not be very much better off carrying a carbine of the best sort than carrying a rifle, when you consider the mobility that you require of them in getting across country and in performing scouting and outpost duties. I must just say one more word for the Yeomanry. I have had some experience of them, and I feel quite certain that anything the Yeomanry are asked to do, they will do, and do it well. As regards shooting, it has sometimes been said that they won't or can't shoot; but, as a matter of fact, they have never seriously been asked to shoot yet. It is no part of the requisites for a man to become an efficient, and the only wonder to me is that they shoot as much and as well as they do. I think the chief difficulty that has been experienced in this question in talking to Yeomanry Officers and others as to what Yeomanry are to do, has not been the question as to whether they are willing to shoot and act on foot, but as to what they are to be called. You say "what's in a name?" But there is a great deal in a name, and Yeomanry are naturally proud of their name as cavalry, like other people are proud of their regiments, whatever they may be. It seems to me very important to consider whether it is a wise thing in this scheme of Colonel Hutton's, in proposing to form a force of Mounted Infantry, to denude Volunteer regiments of their best men to form a *corps d'élite*. This objection has been often raised against the very Mounted Infantry which Colonel Hutton commends, and it deserves serious consideration. I think before making up one's mind to spend money on an experiment, it would be only fair to the Yeomanry to give them a fair chance first; and, putting them on a sound financial basis, and telling them really what standard of efficiency is expected of them, to see whether they will fulfil it.

Captain ELVERSON, Adjutant 4th V.B. R. West Surrey Regiment: As an Adjutant of a Volunteer corps to which a section of Mounted Infantry is attached, seeing that no speaker has so far in the discussion touched on the subject of the training and organizing of Volunteer Mounted Infantry which is the subject of Colonel Hutton's able paper, I think I ought to strike a few of the difficulties met with in raising and training such a force. 1st. There are no qualified instructors. A Volunteer Officer raising a section of Mounted Infantry must be its instructor, and he knows nothing about riding school drill, and nothing about cavalry drill, and without some knowledge of these the section when mounted cannot be manoeuvred. 2nd. It seems to me we want a school of instruction to which Officers and men of Mounted Infantry could go, say for a fortnight (if they so wished), and be instructed in the riding school, and in drill and tactics as Mounted Infantry, and such other special duties as an ordinary infantry instructor is not qualified to teach. An Officer of my corps was attached to the Regular Mounted Infantry at Aldershot last year for ten days or a fortnight, and his hotel and horse expenses amounted to something like 3*l.* a day. Such an expense is prohibitive. There are now some ten or twelve men of the section who would like to be attached for instruction to the Mounted Infantry at Aldershot if the expenses could be lightened by quarters being provided for them and stables and forage for their horses. With regard to the remark of a previous speaker, that "by forming sections of Mounted Infantry in Volunteer corps, you would deprive a corps of all its good shots and impair its efficiency," my experience is that a different class of men altogether come in as Mounted Infantry. They are men who

can afford to keep horses, and if we did not take them as Mounted Infantry they would not join the Volunteer Force at all.¹

Captain ELLIOTT LEES, M.P., Dorset Yeomanry: My only excuse for rising must be that which has been offered by several former speakers. I happen to be a yeoman, and strange as it may seem to Colonel Hutton, I am very proud of that branch of the Auxiliary Service to which I belong. I was very much puzzled at the rôle we are asked to play. I found as much difficulty in understanding the distinction between Mounted Rifles and Mounted Infantrymen as General Keith Fraser did. May I suggest to General Keith Fraser the old joke of a man who is the "hossiest man on foot and the footiest man on a horse" that has ever been seen? I take it, according to Colonel Hutton's definition, the Mounted Infantry will be the "footiest man on horse," and the Mounted Rifle will be the "hossiest man on foot." I must say I do not think any man could be properly taught to ride in four days. "Riding taught in four days!" Certainly, you would have a great many recruits joining the riding school, if only to learn how to ride. It would be rather rough upon the Masters of Hounds in those localities, but I have no doubt many men will join for the sake of learning riding in four days. What have you to do? You have not got to go galloping about; what you have to do is, to get a camp stool, a piece of blue foolscap paper and pencil, and in that way you are going to train I do not know how many thousand Volunteers to ride and act as Mounted Infantry. Perhaps that chaff may pass, and I may say, seriously, that I should like all those who have listened to the lecturer to remember one point in Colonel Hutton's lecture, and another point which has been brought out by subsequent speakers. I mean the great deficiency in Auxiliary Cavalry pointed out by Colonel Hutton, and the very great change that has taken place in the condition of the Yeomanry Force of late years. There is a very great change indeed as anyone who has seen them within the last six or seven years will bear witness. We have got rid of the plough-boy on the carthorse, and the fat publican on the cabhorse; we have a very much smarter class of recruits, fewer in numbers, but the quality very much better than formerly. The system of five years' appointment for Adjutant, the very good Training School established at Aldershot, and the system of going out for ten days' training instead of only six, has worked a very considerable change in the efficiency and capacity of the Yeomanry of the country. They shoot very fairly now. Anyone who will compare the scores of the first fifteens of the Yeomanry at Bisley and Wimbledon during the last few years with those of the first fifteens of the Regular Cavalry will find that the Yeomanry have made the better shooting. In that enclosed country of which Colonel Hutton spoke as the country in which any invasion of England would have to be met, may I ask whether the carbine which is fairly trustworthy up to 600 yards, would not be quite as effective a weapon as the longer rifle? Is it likely in that enclosed country, any longer ranges would be necessary than 500 or 600 yards, up to which we may trust the carbine as much as the rifle? But suppose the invader who is assumed to be strong in a picked Cavalry Force, suppose he was to force a battle in open country. It is not to be supposed that the leader of an invading army landing in this country with 11,000 picked cavalry would, if he could avoid it, give battle in a country where those cavalry would be of no use at all. He would try and find a place where his picked cavalry could operate. Is it to be supposed if he did force a battle in a country where he could operate, no Auxiliary Cavalry could oppose them? As the Yeomanry Cavalry were a few years ago, I think it would have been madness to oppose Regular Cavalry. As they are now, a very few squadrons might be able to do so, but as they would be after a little training, I do not think it would be the absolute madness to suppose that they might meet foreign cavalry. Colonel Hutton has quoted the American Civil War; may I reply by quoting our

¹ I think it would be a good plan for the mounted sections of the corps of brigades to assemble once or twice a year for a combined drill under some qualified Regular Officer. This was tried in London this year and was a great success. Colonel Hutton's suggested increase of the capitation grant in the case of mounted men would be very acceptable. At present the men, to a great extent, pay for their equipment and saddlery.

own Civil War 200 years ago, which is the only occasion upon which the class from which our Yeomanry are drawn, the farmers and yeomen of this country, met Regular Cavalry trained in the *ménage*; when, as we all know, after a very short training, Cromwell's Ironsides rode slap through the cavalry of Prince Rupert, trained in the best school of *ménage* of that day? There is another criticism I should like to offer on the proposed school for the Yeomanry. Colonel Hutton points out the very great importance of having Officers sufficiently educated to lead their men, educated, I presume, in tactics and drill, and educated also in the habit of leading men belonging to the same force to which they themselves belong. Where is he going to find men in this country who will join the Auxiliary Forces who have had any experience at all of mounted rifle drill, or where were they to learn mounted rifle drill? He surely does not propose that they should go and study at West Point. How does he propose to furnish the Yeomanry Force with Officers, men who are able to ride, and who will undertake to learn the duties of infantry Officers? I think he will find it very difficult indeed. It would be very difficult indeed, I fancy, to find recruits among the farmers and the proper yeomen class to join a force where their riding is to be quite a subsidiary consideration, and where they are only to be expected to fight upon foot. The great deficiency in our Auxiliary Cavalry has been pointed out by Colonel Hutton. If there is that great deficiency in our Auxiliary Cavalry, is it wise to discourage recruiting such cavalry as we are able to get by insisting that they shall be turned into infantrymen who occasionally ride instead of allowing them to remain as they are, cavalrymen who, I believe, are quite prepared to dismount and shoot on foot when required? There is one point which, perhaps, I may mention here, and that is, I think, in all these questions as to the defence of the country by our Auxiliary Forces we ought to remember this, that although the Auxiliary Forces are assumed as the law now stands, to be only available in case of an invasion, what has always happened in our past history for a great many hundred years back has been, that whenever England has found herself in a strait, she has not waited to be invaded, but has struck the first blow herself, and has found that the best way to defend herself is to assume the offensive. What will be the position of our Auxiliary Forces then? If you send out your Regular Army Corps, after a short time you will want to supplement the ranks that are thinned by war; how are you going to supplement them? You will have your auxiliaries to a large extent volunteer: they will probably be called out and under arms and in training for some time previous; they will be acquiring a considerable knowledge of their duties, and you will have a very valuable Reserve to fall back upon to fill up the ranks of your Army, to take the place of men put out of action. Now, that is, I think, a fact that ought not to be overlooked in considering the position of auxiliaries, and if you have a force of men training as Auxiliary Cavalry and at proper centres, and formed into regiments, so that you could assemble them, and largely recruit their ranks, I have no doubt, on the very threat of an invasion, and train them to perform cavalry duties, you so gain a great advantage in the event of wanting a Reserve to fall back upon to fill up the ranks of your cavalry in case of England being placed in a strait and having to invade an European country. That, I think, is a consideration which is not sufficiently considered in speaking of our Auxiliary Forces. At any rate, I do ask any of those in authority who may be here, to try what the Yeomanry can do—insist upon shooting or marksmanship being necessary towards efficiency if you like, but at any rate as long as you are short of Auxiliary Cavalry, let them remain as cavalry, and do not try and turn good riders into inferior infantry.

General Lord CHELMSFORD, G.C.B.: I have had experience of Mounted Infantry, and I should like to bring the subject back to that point. The whole seriousness of the proposal made in the lecture depends upon whether or not Mounted Infantry is really the proper arm to have as an extra adjunct to our Army. Of course its only experience has been at the present moment in South Africa and in Egypt. In South Africa I have every reason to be thankful for the force which I had under my command, and I can never speak too highly of the way in which that arm performed its duties; but I am bound to say, could I have had the same force of cavalry instead of Mounted Infantry I would have changed it the very next day that

I had the offer. There were one or two occasions where the Mounted Infantry were placed at a very great disadvantage in consequence of their not having any offensive weapon. After Kambula, when the whole of that large army which attacked Sir Evelyn Wood's force was in full retreat, what was the Mounted Infantry able to do? Scarcely anything, because they had only rifles in their hands. Had they all been cavalry it is quite possible that the war would have come to an end after that engagement. The Zulus, when retreating, offered no resistance, and the ground was most favourable for mounted men. But they suffered but little loss; whereas, had cavalry been pursuing, their defeat would have been crushing and complete. Again, at Ginghinloro, where my dear friend the late Colonel Barrow, whose death so many of us still deplore, was in command of the Mounted Infantry, no impression could be made upon the retreating Zulus, for the reason already stated. I am firmly convinced that Mounted Infantry in an European war, where there is a due proportion of cavalry, will be quite unnecessary. The force which Colonel Hutton has so ably and so persistently advocated, and which he commands with such distinction, is one which will be very useful in countries like South Africa or Egypt, provided that the occasion is not considered of sufficient importance to warrant cavalry being sent out in its place, or where the latter may be deficient in numbers; and I am satisfied that cavalry, if properly trained and given the opportunity, can perform all the duties that Mounted Infantry have hitherto done and are supposed to be able to do. I do not see any necessity whatever for increasing the force of Mounted Infantry in this country. I believe it would be a move in the wrong direction. The Yeomanry is an excellent force as a supplement to our Regular Cavalry force; and I believe, if a system of reserves were introduced into it, so that we were able to call upon those who have passed through its ranks to join in case of emergency, that we should have after a short period of training, a force that, in case of invasion, might be relied upon to do good service, in every situation where cavalry could be advantageously employed.

The CHAIRMAN (Lord Hardinge): My lord and gentlemen, I think it is our first duty to return our best thanks to Colonel Hutton for his valuable and interesting lecture. Though there may have been difference of opinion and some slight controversy as regards the respective merits of cavalry and Mounted Infantry, I think we must admit that Colonel Hutton as regards the organization of Mounted Infantry has had great experience not only abroad but at home, and that therefore that is a guarantee that anything he proposes will not be of an unpractical nature. Well now it appears to me that in all these military improvements and reforms there is one very important element, and that is the element of money. We cannot improve our recruiting system without money. We cannot improve our guns, we cannot improve our rifles without more money. Nor can we add to the defensive forces of the country without more money; therefore when Colonel Hutton comes here and proposes a grant of only 1*l.* per head for the Volunteer Mounted Infantry by which means he would get a mounted force, whatever their merits may be, of 6,000 mounted men and upwards, I think he makes a moderate proposal as regards money. That no doubt would be a great incentive to the Government taking the matter up, because as we all know the Treasury and the House of Commons are very difficult to deal with,—I won't say the House of Commons, because I think the House of Commons are rather well disposed towards the Volunteer Force, of which there have been many instances. I would only draw attention to what has happened with regard to the field artillery and the Volunteers; it is very much the same case as the cavalry and the Mounted Infantry. It was felt that our field artillery in England was out of all proportion to the forces of the country, and that can be very easily shown by any artillery Officer. The Royal Artillery had no great faith in Volunteer field artillery, but such was the pressure placed upon the Government by the necessity that had arisen that they gave a grant of something like 130*l.* per battery for every Volunteer field battery that turned out so many men and horses for inspection. Well what are the reports about these Volunteer field batteries? Nothing can be more satisfactory; they have quite astonished military men by the way they have turned out. Well then how are the horses got? The horses are got very much as Colonel Hutton proposes to get

his horses, by contract, and these Volunteer field artillery turn out for so many days' drill, and work extremely well. One point on which I am at issue with Colonel Hutton is that I think his Volunteer Mounted Infantry should turn out mounted every year instead of biennially. However, Colonel Hutton has had great experience in this respect, so that I would bow to his decision in this respect. We have heard something about an invading force on the shores of Kent and Sussex. I know that country pretty well, having lived all my life in it: it is exactly what hunting men would call an excessively cramped country; in fact, with the exception of the country round Canterbury and Dover, if hounds really run, horses cannot live with them; they have to go across gullies, which we call gills, and all sorts of obstructions in the Weald of Kent. I would say one word about our Regular cavalry. What does our Regular cavalry amount to? I believe our Regular cavalry, excluding India, in this country, consists of about 15,000 men, and about 9,000 horses. I ask you cavalry Officers are you satisfied with that amount? ["Most certainly not."] Every cavalry Officer will agree with me when I say it is out of all proportion to the other arms. Then I ask General Fraser, or any member of the House of Commons that is here, what chance have you of getting your Regular cavalry increased? You cannot improvise cavalry; if war breaks out to-morrow you cannot bring into action more Regular cavalry: it takes a long time, as every cavalry Officer knows. Therefore you cannot improvise them. What did the Duke of Wellington say in his famous letter to Sir John Burgoyne? He said, "I know I cannot get more Regulars, the Government and Parliament will not give me more Regulars." It is the same with cavalry. Government and the House of Commons will not give you more Regulars. Then what did the Duke say? "If I cannot get Regulars," he said, "I will do all I can to improve and increase the Militia." Very well, nobody ventures to assert that the cavalry are not quite first rate, but if it be true that we cannot get more cavalry, what is the next best plan to adopt? The Yeomanry we have heard are as efficient as Yeomanry can possibly be, but there are only 11,000 of them,—a mere drop in the ocean. You cannot materially increase your Yeomanry. If you cannot increase your Yeomanry and your Regular cavalry, what are you to do? You must fall back very much upon some plan like Colonel Hutton's by which he proposes to give you 6,000 more mounted men in the shape of Volunteer Mounted Infantry. That too is rather a drop in the ocean, but still it is something, and he proposes to train and equip them very much in the same way that the Mounted Infantry are now trained. I ask is his principle of Mounted Infantry good or bad? The Government say the principle is good. They have adopted it; it is sanctioned, it is carried out. I ask the cavalry Officers who are here and were at the Berkshire manoeuvres, are the Mounted Infantry a failure, or are they not? I have always heard from different quarters that it was a complete success; however, that is a question which of course must be left to the judgment of cavalry Officers and other persons who are well versed in such details. I will only say one word more about Colonel Hutton's details as regards Volunteers. I do not approve of the biennial system, I think they ought to come out, if possible, every year. Of course that would increase the expense. I think we could very easily hire small cobs in the different large towns, and I do not think there would be any difficulty in getting good Volunteer Officers for these different divisions, but of course once the thing is started, no Volunteer Officer must be appointed to a Division unless he undertook to go to Aldershot and make himself master of Colonel Hutton's special drill—being attached to the Mounted Infantry for that purpose. Now as to taking the *élite*, I do not see it is absolutely necessary to take the *élite* of every regiment in the shape of marksmen. You would take men who combined all the necessary qualifications as far as possible, and were at the same time time good shots. You would take men who knew something about horses. If they were first-class shots, well and good, but I am not quite sure whether it would answer to take only the marksmen and very best shots, because they might not be so generally efficient as other men in the battalion who would be better "all round." As for riding I will venture to say in my battalion we could find thirty men who would very soon learn to ride well enough for Mounted Infantry purposes. Then care should be taken about the height of the horses: they should be horses that you could get on and

off very easily. Uniform there would be no difficulty about. But whatever the controversy may be about Cavalry, Yeomanry, and their respective efficiency, I must say it seems to me it is a system which might be fairly tried. My noble friend Lord Chelmsford has thrown cold water upon the Mounted Infantry. I recollect Lord Chelmsford making a speech in the House of Lords in favour of Mounted Infantry, and wanting to know why the Government did not adopt it. Some ten years have elapsed since that time, and I suppose he has now good reasons for modifying his views. I will not detain you any longer, especially as Colonel Hutton is anxious to reply to many of the objections which different Officers have brought against his scheme.

Colonel LONSDALE HALE: Might I rise to a point of order? We have had a number of Yeomanry views, but the purpose of this paper I understood was to elicit the views of Volunteer Officers on the subject. I would ask whether time would permit of Volunteer Officers being heard?

The CHAIRMAN: I think Major Balfour is the only Officer who has put down his name as a Volunteer. I should be perfectly ready to hear any Volunteer Officer who wishes to give an opinion. I was only afraid it might be getting too late.

Captain THOMPSON (Adjutant Dorset Yeomanry): May I address a remark on a very important subject on which, I think, the lecturer has totally misinformed us? The lecturer states that he can supply us with 6,864 Mounted Infantry at a cost of 1*l.* per annum per man. This, as a matter of fact, is an addition to the grant they get already of 35*s.* per man for capitation grant as efficient Volunteers, so that Colonel Hutton's 6,864 men instead of costing the equivalent number of pounds will cost 18,876*l.* And this he says is *without* saddlery; he says the saddlery can be *lent* by Government to the Mounted Infantry. Again, this force of 6,884 men will draw their contingent and extra grant *annually*, while they only train *biennially*, so that they are paid exactly 9,438*l.* for a day's mounted work. For a less sum than that we already provide Yeomanry who are fully equipped, who ride their own horses, who have their own saddlery, and who can turn out at a moment's notice for 3,818*l.* per diem of mounted work, and in that sum I take into consideration the 7*s.* a-day pay which every yeoman gets. I think it would have been unjust to let the idea go to the Press and to the country that Colonel Hutton can provide a cheap force of 6,000 Mounted Infantry for 6,000*l.*¹

Lieut.-Colonel HUTTON (in reply): My lord and gentlemen, your lordship has remarked that I have some anxiety to reply to the many criticisms. Well, I may fairly say that I have a great deal of anxiety! Before replying to each gentleman, as far as I can do categorically, I should like to make a few general observations. Firstly, this paper was written purely for the Volunteer Forces. It was written because I have been in correspondence with many Volunteer Commanding Officers throughout England with reference to this very Mounted Infantry movement, and the various questions arising therefrom, and it was with a view to afford some practical solution of the fundamental difficulties which the Volunteers themselves have experienced that I have written this paper. It is purely out of sympathy to the Volunteer Mounted Infantry movement. Secondly, it was impossible for me to take up this question of the Volunteer Mounted Infantry movement, sanctioned, as it has been, by the State, and which forms part of the Volunteer Infantry forces, without touching upon the Yeomanry. I did so with great deference, as it is a force of which, in the nature of things, I have not the same intimate knowledge as many here. I would commence by saying that Colonel Crichton's lecture, the other day,

¹ 6,864 Mounted Infantry at 2*l.* 15*s.* per man annually = 18,876*l.* annually. As they are only trained biennially, therefore cost of one training of 4 days = 37,752*l.*; therefore cost of 1 day's Mounted Infantry work to nation = 37,752 ÷ 4 = 9,438*l.* + pay and saddlery.

6,864 Yeomanry including contingent allowance and pay at 7*s.* per man for 6 days at 7*s.* and 2 days (troop drills) at 3*s.* 6*d.* = 30,544*l.* annually; therefore cost of 1 day's Yeomanry mounted work to nation = 30,544 ÷ 8 = 3,818*l.*

Balance in favour of Yeomanry including pay and saddlery over proposed Volunteer Mounted Infantry = 5,620*l.* per diem mounted work.—C. W. T.

was one which misled many of us who read it and were not present to hear it. If I have misrepresented his views, as I appear to have done, and also those of nearly every Yeomanry Officer here, I regret it extremely, but I think that my meaning has been in some respects misunderstood. I merely put into the form of an interrogative the query whether the Yeomanry would accept a situation very much akin to the action of the American cavalry at the commencement of the American War. If we may judge from the spirit that has been shown by Colonel Crichton, Lord Airlie, Major Long, and others, it is an undoubted fact that they do intend to devote their energies to increased efficiency, and they will accept a *rôle* much akin to that which I have sketched. Now, as regards Colonel Crichton's lecture, I speak as an individual who merely saw the account of his lecture in the papers; my view, and the view of a great many, was that the Yeomanry Service would not accept any *rôle* except that of the cavalry of fifty years ago, when dismounted service was considered unnecessary, and, indeed, derogatory to their prestige as cavalry. Many Yeomanry Officers here have put the fact very clearly before us all, that their earnest wish is to develop the value of their Service by careful attention to dismounted duty, and this declaration is, I think, one of the great advantages which has arisen, and will arise, from this lecture. As to whether the Yeomanry can or cannot take their place in line with our own Regular cavalry in any European complication is a question which I will, with your permission, leave open. Thirdly, there have been many criticisms upon my proposals for a Volunteer Mounted Infantry, about the length of time given to teaching men to ride, and various other details. I frankly admit that the scheme is open to much criticism; any proposal that is new must be open to drastic criticism, it can hardly be worth anything if it is not so! The last speaker has criticized the financial aspect of the question. I can only reply that I very carefully went into the points he raises, and if I have blundered I regret it. So far as I know, the scheme is financially sound. I would, however, ask whether any gentleman has any other, or more practical, solution to submit with reference to this Mounted Infantry Volunteer movement? Can any gentleman here propose any better scheme by which you can practically utilize what the Volunteers themselves have initiated, and have in existence at this present moment? Can any of my critics propose any other scheme for making practical use of what Volunteer Mounted Infantry there is in existence now? If you cannot devise any practical scheme, it is an undoubted fact that the present Mounted Infantry detachments are of little or no value, because they cannot be reckoned as a solid factor in the defence of the country. Fourthly, many of the speakers have criticized my paper as involving the Mounted Infantry question generally, and not as it affects the Volunteer Force. I do not propose to go into the controversial part of the question, it is not the object of this paper to do so. The War Office authorities have accepted the principle of Mounted Infantry, both among the Regular and Volunteer Forces, and it is not necessary, therefore, to go into that question. I must begin by apologizing to Colonel Savile for having alluded to his corps as on "mechanical contrivances." He must forgive me, but it was exactly with reference to his corps that the expression, "mechanical contrivance," was inserted, and I advisedly did not make use of the expression "bicycles," because many of the Cyclist Mounted Infantry at Aldershot are provided with strange-looking contrivances, which are not exactly bicycles, and it was rather difficult to embrace in one term the whole of the different descriptions of cycles. I therefore summarized them all by the words, "mechanical contrivance." I hope that Colonel Savile will accept my apology for not having referred personally to him and to the corps which he commands. I trust that he will assign it entirely to my ignorance that I did not allude to the organization which he has told us exists in his corps of Cyclist Mounted Infantry. With reference to Colonel Crichton, I think I have already sufficiently referred to the gist of his comments in the course of my preliminary observations. General Keith Fraser has, I think, rather summarily jumped at the conclusion that I have not read the history of the American War correctly, and that I have assumed that the American cavalry never executed any charge. Of course, every student must recall the Battle of Winchester, in 1864, which was, perhaps, one of the most conspicuous examples of a large force of cavalry charging with sabre or with pistol, and performing also dismounted work.

During the later phases of the war, it is well known that the American cavalry charged over and over again, both with sabre and pistol. In common with every reader of the histories of that time, I am well aware of the rôle acted by the cavalry of both North and South, but at the commencement of the campaign, before they were developed into practically Regular cavalry, their initial rôle was that of "Mounted Rifles." My remarks as regards the comparison of the capabilities of our Yeomanry with the characteristics of the Southern cavalry referred entirely to the early stages of the war. Later in the war the Southern cavalry partook of the character of Regular cavalry, and similarly the cavalry of the Federals which fought at Winchester, and which subsequently caused the surrender of the Confederate Army at Appomattox Court House, were Regular cavalry. These cavalry had then been organized for four or five eventful years, and it is impossible to have a finer cavalry than one organized in the field under circumstances such as these. The Southern cavalry, which at the commencement of the war fought under Morgan, Forrest, and others, never attempted European cavalry tactics, and never contemplated a charge with sabre or pistol in hand. It was only subsequently, when matured experience and practical knowledge converted the original Volunteer cavalry into the finest cavalry in the world, that a development of their tactics became possible. I have ventured to doubt the possibility of the Yeomanry, after two months' training, being able to act against European cavalry. I can only say, of course, that I allude to European cavalry of the best type. Surely our Yeomanry, even after the two months' training contemplated by one of the speakers, could hardly emulate the tactics and work done by the American cavalry after four years' training in the field, and combine the perfection of dismounted work with the shock tactics of European cavalry. Lord Mount-Edgcumbe referred to his company of Mounted Infantry, and told us that they were practically "Mounted Rifles." It was not with reference to his company, perhaps, so much as with reference to the Mounted Infantry generally throughout the Volunteers, that my paper was written. He pointed out the difficulty of Mounted Infantry scouting, unless they were given an *arme blanche*, or something with which they could defend themselves if attacked by cavalry, and there is not the slightest question of the correctness of this view. This is one especial reason why I have endeavoured to draw the distinction so strongly between infantry mounted for purposes of locomotion, and mounted riflemen expected to do outpost duty and other duties of cavalry, except the "shock." In order to do outpost duty and independent work of that kind, it is necessary to give men an extra arm; whether it be a sword or a pistol is a matter of detail. With regard to Colonel Wood's statement about the Mounted Infantry marksmen, I rather think that he was perhaps misled by my explaining, on one occasion, to him, at Aldershot, that with reference to the selection of infantry soldiers for Mounted Infantry work, the direction from the Adjutant-General made no mention of the necessity of the men selected being "marksmen." The fact is that a man may be a marksman this year and not next. This year, in particular, the number of points being raised by which a man can become a "marksman," will find some of the battalions at Aldershot with only one or two marksmen under the new Regulations. By the expression "marksmen," used in my paper, I intended to convey the idea, not that the men actually had badges on their arms, but that they were good shots, and selected by their Commanding Officers as such. In the Berkshire manœuvres last year there were three companies of Mounted Infantry, about 400 men, and of this number 44 per cent. were marksmen, and wore the badge as such. These companies were only a fair sample of the total number of twelve companies. Captain Elverson and Colonel Alt have pointed out the very difficulties which my paper has been written really to meet, namely, that the Mounted Infantry detachments at the present moment have no proper system of organization, no means of instruction, no adequate assistance given them, and therefore I submit that it is impossible for Volunteer Mounted Infantry so existing to maintain any real efficiency, or to be dealt with as practical factors in the defence scheme of this country. I have only now to thank you for your kind attention to my paper.

Friday, June 12, 1891.

CAPTAIN WILLIAM J. L. WHARTON, R.N., F.R.S., Hydrographer
to the Navy, in the Chair.

THE HANDICRAFT OF NAVIGATION AND NAUTICAL SURVEYING.

By Commander T. A. HULL, R.N.

THERE is a tendency in the ordinary man who works with his head to regard as common and something inferior to himself his brother man who works with his hands. The age may be called Republican, but there is as much of this folly around as in the days of Tiberius Cæsar.

The worker or mechanic is placed below the thinker or scientist; men may not say as much, but they think as much, and, where they dare, act as much. Hence Shakspeare, that knower of humanity, makes Puck describe Bottom and his mates as "rude mechanicals that work for bread upon Athenian stalls." This complaint is not confined to any one class of humanity; in the vigorous language of the vulgar, "we all do it," and as the smallest creatures are said to have smaller things to bite 'em, so the lowest man has some "rude mechanical" to contemplate beneath him.

I once heard a man, considered learned on shore, slur over all the trouble and experience required in sounding the Atlantic Ocean with these words: "The mechanical difficulties of a deep sea sounding having been overcome." Poor man, where would he and his speculations have been without the aid of these "rude mechanicals?"

Now Mother Nature does not approve of this conduct in her children; she will not permit the simple to be despised with impunity. She knows the importance of the little things in life, and so in an unseen manner lets our stupid actions bring about disastrous effects, which some men term "bad luck," others "a mysterious Providence," and some few real thinkers ascribe to man's own foolishness and "cussedness."

Pilotage, or the art of navigation at sea, has suffered from this human fad. The pilot was, and is still by some, looked upon as one of Puck's "rude mechanicals," a man of the many, who could readily be replaced, and yet the calling has around it the halo of the pride of ancient lines. Late discoveries in the history of the Chaldees name a pilot for the Ark; Tiphys is the pilot of Jason in the "Argo;"

Palinurus, of Æneas; Pelorus, of Hannibal. The sailor of canvas may pass away, some electric forces may supersede steam, but while the sea remaineth, you will want the pilot.

In this paper I shall use the term "pilot" as our sea fathers used it, as applying to the sailor whose duty it was to conduct the ship from one point to another, by objects celestial as well as terrestrial. This ancient and honourable title has been borne by Officers in the present century. I hold here my commission as "Master and Pilot" to H.M.S. "Havannah" in 1855.

The sweet simplicity of the sailings and nautical astronomy on paper has lent itself to aid the delusion in the minds of the learned that the mystery of the pilot could easily be acquired; so while the science of navigation was taught, the handicraft was neglected. In the pretty study of navigation on shore they thought they had acquired the knowledge of navigation at sea. Well, they had *a* knowledge, but not *the* knowledge. They knew not the element on which their learning was to be practised. They forget the benediction of the dying Patriarch, "Unstable as water, thou shalt not excel." *Unstable as water*; remember that. This instability naturally produced impediments and uncertainties well known to the old sailor. In 1607, John Davis the navigator writes thus in "The Seaman's Secrets."

After treating upon the laying off the course, distance, and therefrom the position of the ship, he continues:—

"And after this sort he proceedeth from place to place, vntill he arrive vnto his desired porte, which is a conclusion infallible if there be no other impediments (whereof there hath not been good consideration had) which may breede errour, for from such negligence there may arise many inconuencies.

"What may those Impediments be?"

"By experience at sea we find many impediments that so disturb the expected conclusion of our practices as that they agree not with the true positions of arte, for, first, it is a matter not common to haue the winde so beneficial as that a ship may saile thereby betweene any two assigned places vpon the direct corse, but that by the contrarietie of windes she may be constrained to trauers vpon all points of the Compasse.

"Secondly, although the winde may in some sort fauor, yet the ship may haue such a leward condition as that she may make her way 2 or 3 points from her caping.¹

"Thirdly the stredge² may be so disordedly handled as that thereby the Pylote may be abused.

"And lastly the compasse may be so varied as that the Pilote may likewise thereby be drawne into errour; at all which things and many moe, as the nature of his sailing, whether before the wind, quartering,

¹ Heading or keeping a course.

² Steerage or stredge, may stand for stretch, a term for a ship's course when beating to windward.

or by a bowling, or whether with lofty or low sails, with the benefits or hinderances of the sea, tides, gates, streames, and forced set thereof, etc., of all which things (I say) the skilfull Pylote must haue consideration, which are better learned by practice then taught by penne, for it is not possible that any man can be a good and sufficient Pylot or skilful Seaman but by painful and diligent practice with the assistance of arte, whereby the famous Pylot may be esteemed worthy of his profession, as a member meete for the common weale."

Here is good evidence for the necessity, now as then, for practical experience in making a good pilot. The mastery of the ocean can neither be learned on shore nor taught by landmen; it can only be acquired by incessant practice on shipboard and at sea under the tutelage of seamen who will consider John Davis's impediments, and impress upon their pupils this Shakspearean couplet—

"Experience is by industry achieved
And perfected by the swift course of time."

Gentlemen from the universities, cunning, doubtless, in mathematics as used on shore, are sent without any sea training to teach sucking Nelsons (N.B.—Please to remember Nelson proved himself to be a pilot as well as an Admiral) mathematics to be used at sea. Now, are men without any sea training qualified to teach the handicraft of navigation at sea? Some, I admit, have done good service by giving heed to, and themselves studying, navigation at sea under the master of the ship. Let a Naval Instructor serve a year at sea and then pass a *bonâ fide* nautical examination before sailors at the Admiralty before he be pronounced qualified to teach navigation at sea. He may then comprehend the deep meaning of the secret of the sea, so well alluded to in Longfellow's verse. The noble Count Arnaldos would learn the sailor's mystic song—

"'Wouldst thou,' so the helmsman answered,
'Learn the secret of the sea?
Only those who brave its dangers
Comprehend its mystery.'"

I will here read some remarks made by Thomas Carlyle on Columbus, not out of place, because it treats upon the

"Glorious mirror where the Almighty's form
Glasses itself in tempests."

"Brave Sea-Captain, Norse Sea-king,—Columbus, my hero, royalest Sea-king of all! It is no friendly environment this of thine, in the waste deep waters. . . . Brother, these wild water-mountains, bounding from their deep bases . . . are not entirely there on thy behalf! Meseems *they* have other work than floating thee forward:—and the huge Winds, that sweep from Ursa Major to the Tropics and the Equator, dancing their giant-waltz through the kingdoms of Chaos and Immensity, they care little about filling rightly or filling wrongly the small shoulder-of-mutton sails in this cockle-skiff of thine! Thou art not among articulate-speaking friends, my brother;

thou art among immeasurable dumb monsters, tumbling howling wide as the world here. Secret, far off, invisible to all hearts but thine, there lies a help in them: see how thou wilt get at that. Patiently thou wilt wait till the mad South-wester spend itself, saving thyself by dexterous science of defence, the while; valiantly, with swift decision, wilt thou strike in, when the favouring East, the Possible, springs up."

In Shakspeare's "Tempest" the courtiers worry the boatswain, telling him to be patient; the boatswain replies:

"When the sea is—— Hence! What care these roarers
For the name of King? To cabin: silence! Trouble us not."

In most trades there are necessarily suitable garments in which the labours of the craft are carried on. We have here the working rig of the pilot, without which he would have but little chance of mastering the mystery he has chosen, for, however easy navigation may seem when carried on free of care and anxiety in a comfortable college or law court on shore, pilotage, common and proper, will be found a very different business when pursued by responsible men in a gale of wind at night, or in hazy weather on board a ship at sea.

A set of these sea garments should be presented by the Admiralty to every professor at Greenwich, and to each Naval Instructor on their first appointment to college or to ship; to remind them that they have to teach a science and a handicraft that is most wanted by their pupils, when those pupils, as toilers of the sea, join battle with the angry and apparently merciless elements.

I will now call attention to the tools of the handicraft, so well known to all sailors that some apology is needed for bringing such commonplace implements before them. I have little new to bring forward. I refer to important but sometimes, alas, neglected simplicities known to common men. Some years ago Admiral Sir George Richards, as chairman at an examination in pilotage, made a remark that I have never forgotten. The candidates had not been quite of the best, had overlooked much of the information placed at their disposal. When consulting over their fate, Sir George thought it would be a good thing if the bottoms of their chart boxes fell out once a month, so that in restowing the box they might discover the treasures within. Consider my paper as a sort of restowal of the chart box, in which most of us will find old acquaintances, and some few, perhaps, may find new.

The tools required in the handicraft of navigation are as follows:—

Anchor—Mariner's Compass—Burdwood's and Davis's Azimuth Tables—Lead and Line—Log—Chart—The Globe—Parallel Rulers, Dividers, Protractor—Pencil and Rubber, Tracing Paper—Sextant—Artificial Horizon—Chronometer—Barometer and Thermometer—Telescope and Binoculars—Wind and Current Charts—Tide Tables—Nautical Almanac—Raper's Practice of Navigation—Rule of the Road—Admiralty Pilots—Lecky's Wrinkles and Danger Angle—Sailor's Pocket-Book.

Anchor.—Who does not know the anchor, the hand of the ship, the emblem of our craft, an important instrument in navigation at sea, taking a sailor some years of experience to learn its use; to know when to let go; to have eye to see his ship has room enough; knowledge of the ground as to whether the hand of his ship has anything to clutch; knowledge of the rise, fall, and set of the tide? How often has the anchor saved the ship? Let instructors of navigation at sea consider the anchor!

Steam has much simplified the use of this tool. As weighing is no longer a job for all hands, the anchor may be more often used than formerly. Anchors still have a way of coming up foul, the clearing of which in bad weather or under fire will require all a sailor's wit and readiness.

Mariner's Compass.—Then the compass, the heart of the ship, well defined by John Davis as "a principal instrument in navigation, representing and distinguishing the horizon." This heart is now somewhat diseased by the body of iron in which it is placed, therefore the practical methods of ascertaining and applying the deviation caused by that iron should be one of the chief studies of the modern sailor, and no opportunities lost of getting the error by every available means celestial and terrestrial. As in 1607, so in 1891, the sailor should have "a carefull regarde vnto his stereag with very dilligent examination of the truth of his compasse, that it be without variation or other impediments." Good friends, to this "very dilligent examination," are the well-known azimuth tables of Burdwood and Davis, said by some to be the best practical works on the deviation of the compass at sea. This constant observance of the error of the compass in fair weather is more than ever necessary, so as to know the error on each point during weeks of foul weather, that may be met with in some climates.

Inventions to reduce the deviation and facilitate the finding of the errors are many, and new men like new tools. I have here a compass and an azimuth by my friend Mr. Hughes, of Fenchurch Street, which commend themselves by their simplicity, and are well reported upon. The mechanism for reducing the deviation is simple and easily handled.

Log and Dead Reckoning.—Dead reckoning has not met with the attention it deserves. Dead reckoning is a fine art, dependent upon good observation, celestial and terrestrial, to start it, and on good steering and logging to carry it on; remember the remark of John Davis, "the stredge may be so disorderly handled as that thereby the Pylote may be abused." An old sea proverb, "If you want to clear a rock, steer for it," shows the known difficulties of keeping an absolutely correct course at sea. Dead reckoning is also dependent on a correct knowledge of probable currents and tidal streams, on the winds that have been and are blowing.

Logs, whether patent or common, are unsatisfactory instruments in these days of high speed. No patent log yet invented will stand the wear and tear of a fast ship for any length of time. To avoid this wear and tear they should be used only when coasting or in with the

land. They tell a different story in a head sea to what they do in a following sea. In slow steamers and sailing ships they are naturally more reliable. Still, logs are not to be given up as useless, but it must be remembered they are beset with *impediments*, and their indications must not be implicitly trusted in critical times.

By practice, seamen learn to estimate the rate of progress of the ship closely by the number of revolutions in a given time made by the engines; but this is only speed through the water; the sailor has to consider carefully what that *unstable* element has *also* been doing.

Further, though ships now may better preserve a given course, and the distance run may be estimated more accurately than formerly, there are in modern iron ships elements of uncertainty about dead reckoning which still makes it perilous to close the land unless there are means of knowing with some certainty the ship's proximity thereto, especially where land has a bad reputation, as Cape Finisterre, Cape Guardafui, Mocha Island in South America, &c.

Good dead reckoning, like all other things, can be kept by practice. Let the position by dead reckoning be always considered a serious matter, to be carefully compared with the position obtained by observation. If there is a difference between the positions, let that difference be accounted for, and if it exceeds that probably caused by known tides or currents, let it be considered that the distance has been wrongly estimated or the stredge so disorderly handled as that thereby the Pylote has been abused. Let more care be taken the next day, and so on until a confidence is engendered in the dead reckoning that may be useful in closing the land in thick weather.

The Lead.—Closing the land in thick weather naturally introduces the antennæ of a ship, her lead and line by which she, with comparative safety, feels her way in the dark. There are many sounding machines. Here is one of the latest, by Messrs. Cooper and Wigzell, apparently well received by our Navy and mercantile marine. I would here call attention to an interesting paper on Sounding Machines, read at this Institution by Professor Lambert, of the Royal Naval College, Greenwich, on 3rd June last, to the discussion thereon, and to the remarks of Sir W. Thomson and Captain Wharton.¹ An ingenious machine, James's "Submarine Sentry," was then exhibited. Sir W. Thomson's invention of sounding with piano wire is in general use in steamships belonging to the Mercantile Marine. Birt's buoy and nipper is a simple instrument, well known in Her Majesty's surveying ships: having used it myself for many years, I can strongly recommend it.

As an ancient I would advise the sailor's testing and practising these patents in fair weather, so that if they are worth anything he may learn to trust them in foul; to see his mates know how to use and set them. In our Channel and similar waters it may be as well to keep an eye on the old "marks and deeps." The sling and the stone of the shepherd was once preferred to the improved armour of a king.

Not very long ago, in a ship coming up Channel in dirty weather, I saw a cast of the lead obtained, an up and down cast. The knots

¹ See *ante*, p. 765.

on the line said 45 fathoms; the machine gave 35; the knots were right. I am not going to abuse the machine, it might not have been properly set; I only give the experience. A single cast of the lead is not fairly using the lead, several casts are required, noting the same on tracing paper and seeing how they fit on to the chart.

The Chart.—This introduces us to a serious document, on which are marked the deeds of the ship, something showing her goings out and her comings in; by which she will be judged in the day of trouble; therefore should the sailor know his charts, especially the one in use, so that he sees it as Hamlet saw his father, "In my mind's eye, Horatio." The power of memory, in regard to ideas received from the senses, appears to be strongest in the sense of sight. First-class pilots rarely refer to the chart: they have in some manner transplanted it into their brain. They have the chart handy in case of impediments or questions. The chart should be thoroughly understood, every abbreviation should be comprehended, so as to be read at sight. In fair weather the coast in sight should be watched with the chart, so that the sailor may be accustomed to recognize the land as drawn upon the chart, the various points, peaks, &c., being observed as the vessel passes along, and the changes in their appearances as seen from different aspects, noted. Every light and buoy passed should be observed as to its position, character, and colour, so that they may be known again when encountered under less favourable circumstances.

'Tis thus a chart should be used and studied, every prominent peak, point, cliff, beach, tree, building, light, or buoy seen, should be hunted for on the chart until it is fully recognized. In navigation on shore, these points, peaks, &c., are given to students learning to fix the position of the ship; but in navigation at sea, the points, &c., have to be found or recognized as those shown upon the chart, before bearing or angle can be taken of or to them. A sharp fall of snow will completely alter the aspect of a coast. The land must be known all ways, coming east or going west, and at 5, 10, or 20 miles distant. Close acquaintance with the land helps the clever sailor to either dodge or use those friendly forces to the man who understands them, the tidal streams.

This chart knowledge, useful in peace, is terrible in war, when the skilled pilot, with chart in head rather than in hand, navigates intricate waters and contends with such *impediments* as the removal of lights, buoys, and beacons. This has been done, and will be done again. I have spoken of navigation at sea, but there was one man who understood navigation on shore, and he was the most terrible enemy England ever had to contend with. In 1805, Napoleon, with good maps and dividers, planned the destruction of the Austrian forces; and what he had warily conceived in the Tuileries he executed in the field with the celerity and force of a thunderbolt. Piloting his battalions across the Continent of Europe by his correct knowledge of the roads (courses) and distances, in 100 days he won the famous campaign which began at Ulm and ended at Austerlitz. In the same way, the success of a naval campaign mainly depends upon possessing good charts with able pilots who know how to use them.

I have had with me young men fresh from their examinations, possessing considerable modern confidence, inclined to consider themselves better than their fathers. I have persuaded these young gentlemen to think less of themselves and more of their elders, by the simple process of sending for them on leaving port to take a departure. There was the land, there was the chart, compass, sextant, parallel rulers, dividers, protractor, and pencil, all at their disposal; still, unable from want of experience to connect shore with chart, they broke down at the very alpha of their business. This adventure did them much good. One piece of coast well learnt, there is less difficulty in making the acquaintance of a second; the unities of the universe are on your side. With all her diversities, there is a harmonious similarity in Nature, and her earnest student will soon see how a coast will open out.

The chart should also be used for laying down the "Sumner line," which can be got from one observation, worked once; and by the useful azimuth tables, before mentioned, of Burdwood or Davis. This line of position ruled on the chart may pass over some well-sounded district, when a cast of the lead will give comforting information as to the whereabouts of the ship.

The study of the land and ability to know the peaks on the coast, or on the inland ranges, often enables the sailor to fix the position on well surveyed coasts with accuracy and dispatch, by means of one bearing and the angle of elevation. This small book, the "Danger Angle," by our well known friend "Wrinkles," Captain Lecky, will be found very useful, but there must be no mistake about the peak. Passing a point, or turning a corner like Cape St. Vincent, an angle of elevation placed upon the sextant takes the ship round at a safe distance. The use of the "Danger Angle" in an age when Captains are liable to take every short cut that offers, and shave round capes and corners in a manner to be deprecated, may tend to keep steamships out of danger. As some portions of the world are still unsurveyed, or not surveyed in so full a manner as the requirements of this age of steamships demands, charts of unsurveyed localities are drawn in a light and unfinished manner, so that the sailor, educated at sea, may at once detect that less trust may be reposed upon them.

It is necessary then, on using the Admiralty charts, to observe the date at which the coast the chart exhibits was surveyed, to read the title carefully so as to ascertain what manner of survey it was made from, as it may be from only partial running or sketch surveys; to examine with care the style in which the coast line is drawn, the amount of soundings, and any notations that may be made. By this means will be seen how much reliance may be placed upon the chart.

The charts given to the world are not by any means done with on publication, they have next to be kept up to date. Every Admiralty chart issued is, as it were, a child born to their Lordships, that requires considerable care to insure its doing good instead of evil in the eventful career that may be before it. All recent publications by

Foreign Governments, all reported dangers, all changes in lights and buoys, home and foreign, are as soon as possible inserted on the charts, and notice given of such insertions.

During the year 1889, 47 new plates of charts and plans were engraved, 15 plates improved by the addition of 20 new plans, and 37 plates were partially re-engraved; 4,210 corrections were made to the charts, 115 charts were improved by corrections and additions, 36,115 charts received minor corrections at the hands of the draughtsmen; and 468 notices to mariners were issued.

These facts will show the necessity of these tools, the charts being closely watched by sailors using them, to ensure their being supplied with charts *up to date*. The dates of these corrections are noted at the foot of the charts, those of large corrections and additions, for which the charts have been cancelled, being written in full against the imprint; while the dates of smaller corrections, such as changes in lights or buoys, are noted in Roman numerals in the left-hand corner.

The Board of Trade collects all information on changes and corrections made in all parts of the world, into a small pamphlet, which is issued every month free to the Mercantile Marine.

Charts should invariably be kept flat, ready for the rulers to slide over them, and not be rolled. Rolled paper is always a trouble, an impediment, as Captain Lecky writes in "Wrinkles."

"It will and it won't;
It can't and it don't."

It is a cause of loss of temper, of injury to a good friend; no use getting angry with paper, might as well get cross with a woman. Shallow drawers should be provided in which the sheets can be stowed and numbered, and so be ready for use at a moment's notice.

Parallel Rulers, Dividers, Protractor, Pencil, and Rubber, the Globe.

—The tools to be used with the chart are parallel rulers, dividers, protractor, pencil, and rubber; a piece of tracing paper is handy. A rack should be built for these tools over the chart table. A spiral spring, about an inch in diameter, is the latest dodge for holding pens or pencils; it can be easily fixed to the bulkhead. Care should be taken with the dividers, they must be of good quality, with good joints, which should be kept neither too stiff nor too slack. Here, again, I call for practice, plotting positions in fair weather, so that the ship's place may be found quickly in foul; a wilderness of $x + y$ will not assist the sailor who is not handy with rulers, dividers, protractor, and pencil. Youngsters should be taught to project, *i.e.*, to build to scale with protractor and dividers, every problem they solve. Old Professor Inman, of the old Royal Naval College at Portsmouth, used to say to his pupils in difficulties, "Make a figure." Good, but having made it, they should then proceed to build it. Boys should have those propositions of Euclid that show the powers of the circle, at their finger-ends.¹ For this purpose I here introduce the globe, of which

¹ Raper says, "In geometry it is not the variety of problems which benefit the practical man, but a well grounded and familiar knowledge of a few comprehensive propositions."

instrument John Davis writes: "The use of the globe is of so great ease, certainty, and pleasure, as that the commendations thereof cannot sufficiently be expressed: for of all instruments it is the most rare and excellent." The globe enables the mind of the student of navigation at sea to see the great triangles in the celestial concave by which the problems of nautical astronomy are solved. Aided by the globe, he sees why the times recommended for making certain observations are the best times, and, understanding the practical principles of spherical trigonometry, has a clear comprehension of the little ball on which his ship sails, and that mighty sphere, the universe, in which that atom, the earth, is placed.

Free-hand mathematics may be very well on shore, but navigation at sea is a problem, a thing to be done! Many men can show and talk; what is wanted at sea is doing, with as little talk as possible. The station pointer is a pleasant luxury which one likes to possess, but I cannot look upon it as a necessity to the pilot. A great deal can be done on a chart with small pieces of tracing paper.

Sextant.—Let us now consider the sextant, perhaps the pilot's first and principal tool. If the anchor may be considered the ship's hand, the compass her heart, the lead and line her antennæ, and the chart her record, the sextant may be regarded as her head. The first thought of use of the sextant is to obtain altitudes of heavenly bodies, but it is really an instrument to measure angles, vertically, horizontally, or obliquely. It measures vertical angles in proper piloting, horizontal angles in common piloting. The sextant can, from its delightful portability, be frequently used where masts, sails, funnels, or important personages, who sometimes infest the bridge, obstruct the view from the compass. An angle also is more readily and accurately measured by the sextant than by two bearings taken by the compass. It will readily be seen that in action, when the compass may be disabled or the rifle fire hot, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. This is another reason why sailors should become expert in fixing the ship's position with the sextant. Mind, in thus recommending the sextant, I by no means lose sight of the compass. As in a healthy-minded man the heart works with the head, not too much heart to make him a sentimental silly, nor too much head to convert him into an intellectual idiot, so the practical sailor works compass with sextant, and sextant with compass. Well acquainted with the charming properties of the circle, so beautifully told by old Euclid in his third book, the pilot marries the sextant with the compass, and so obtains a numerous progeny of reliable positions. The sailor looks upon his sextant as a good sportsman looks upon his gun. Getting snap shots at sun or star, under a dirty sky in a gale of wind, is sport to him. The compass is his dog, and points; the sextant is his gun and brings down. In such cases, when the sun appears for a moment like a bright ball of worsted, wait not to discern the limb, go for the centre of the bright mass and bring that to the horizon; you will thus secure an altitude at the centre, within some three miles of the truth, much better than no observation.

The sailor should, therefore, lose no opportunity of making himself thoroughly conversant with this now common, but, nevertheless, invaluable tool, understanding all its adjustments, eccentricity, causes of error, use of the arc of excess, and the means of resilvering its reflectors. At the same time let him take Raper's advice, and remember "the adjusting screws are never to be touched, except from necessity, and then with the greatest possible caution—'over-handly gentlemen' (to use Troughton's language) torment their instruments from ignorant attempts to obtain a perfect readjustment." A too good sextant is as little to be trusted as a too good man!

Sailors really anxious to master the use of the sextant might procure a cheap second-hand one, which can be taken to pieces, tormented with impunity, and experimented upon variously, as a doctor might with an old skull. Silvering the reflectors is capital practice.

In obtaining astronomical positions at sea with the sextant the sailor, knowing the ever uncertain nature of his base the sea horizon, differing as it does according to the different temperatures of air and sea, is content if the position of his ship is determined to a mile; working to seconds at sea is at once waste of time and labour.

A good pilot should possess a first class sextant or quintant, but an old quadrant is also handy, and in bad weather saves the better instrument, whose delicate exactness is quite thrown away getting flying shots at the horizon from the crest of a high Atlantic wave. Jets of salt spray with the chance of a nasty knock, while they may seriously injure the sextant, will do little harm to the quadrant: also the mind is easier.

When thought necessary, greater accuracy may be obtained by working observations in the East against those in the West, meridian observations in the North against those in the South. Working with nearly the same altitudes, the errors on the one side of the horizon counteract those on the other. Here the stars are of the greatest use to the sailor. He should early learn—

"To know night's goodly company of stars,
And those bright lords that deck the firmament."¹

There is but little difficulty in taking stellar observations: the question requires only that capacity for taking mechanical trouble which is natural to the true pilot, while the summings are short and simple. The difficulty is getting the observation accurately, any one can work it out. The star telescope, now fitted to sextants, will be found very useful, showing the horizon on a dark night, when the unaided eye might be several minutes of arc out. Observations of stars in the early dawn and late twilight are of the greatest use to the sailor.

The Artificial Horizon is the natural assistant to the sextant on shore, by whose aid, in the absence of a time-ball or other signal, the errors and rates of the chronometers are found. There are one or

¹ Sailors anxious to acquire a practical knowledge of the names and positions of all the stars of the first and second magnitudes are referred to Jean's "Handbook of the Stars."

two mechanical matters to be thought of in using this instrument. Care must be taken in pouring out the quicksilver. Sir Edward Belcher gives the following useful hints: "Place the finger over the orifice of the bottle, and give it a shake in an inverted position, holding it over the trough previously cleaned. Ease the finger, and allow the mercury to flow gently, keeping the bottle inverted, and taking care to stop the opening of the bottle before the last portion with the dross flows. This will produce a clear brilliant surface."

In pointing the artificial horizon towards the sun, see that the shadow is thrown directly behind it, and not on either side. The spot chosen for making these observations should be sheltered from the wind, and, to be free from vibration, removed from traffic. The roof of the artificial horizon should be so placed that the same glass is always towards the observer. A mark may be made on the glass, or on the framework, to ensure this precaution being carried out. If observations are taken on one side of the meridian only, it may be advisable to reverse the roof, obtaining sets with both glasses, and taking a mean to work with.

Obtaining latitudes at night with the artificial horizon requires some practice; see that it is placed in the true meridian before the observations are commenced. The approximate mean times of the meridian passages of the stars to be used should be calculated from the "Nautical Almanac," the error on mean time of the watch in use should then be applied to them; these times of the meridian passages, *as shown by the watch in use*, should be entered in the sight book, as a guide to the observer, together with the approximate meridian altitudes. The stars selected should, if possible, be of convenient altitudes, neither too high nor too low, stars north of the zenith being paired with stars south of the zenith, of nearly the same altitude. In the northern hemisphere pair with Polaris stars south of the zenith, whose meridian altitudes are within a few degrees of the latitude of the place, care should be taken to find the reflected image of the star in the quicksilver some little time before it comes on the meridian. A handy sailor should be trained to hold the dark lanthorn, by which the observations must be first noted by the watch, and then read from the sextant in such a manner that, while the assistant who is taking time can see the watch, no light is thrown in the direction of the artificial horizon. On the time being secured, the light is taken to the observer with the sextant. Practice is required both in holding the lanthorn and in reading off the sextant. In these days of electricity a handy invention threatens to do away with the handy sailor and his lanthorn. Here is a small portable electric light by Mr. Hughes, of Fenchurch Street, which will be found useful in reading off the sextant at sea or on shore; one might, however, have the lanthorn as a stand-by. The roof of the artificial horizon may require wiping occasionally, on account of the dew.

I would here remark in obtaining the tools necessary for his handicraft, the wise sailor abhors cheap goods as a well dressed man abhors shoddy garments. Deal with trustworthy men who pride themselves

on the accuracy of their wares. Second-hand tools that have been used and tested at sea by reliable sailors, are also recommended; an old sextant by a good maker is as valuable as an old fiddle.

The Chronometer.—A paper could easily be written upon this tool only. I will therefore do little more than call attention to that well-known work "Admiral Shadwell's Notes on the Management of Chronometers."

One remark upon the rates and rating. The practical seaman will never be content to use the rates he may receive with the chronometers on their leaving the shore, when these life-like inventions, to use the Admiral's excellent phrase, are "not naturalized in their new positions." Pressure of business may, possibly, force the sailor to use, for a time, the maker's or observatory rate, but he will take the earliest opportunity of getting his own rate, and watch with a jealous tenderness the performance of these delicate instruments, on whose accuracy the honour and safety of his ship are alike dependent.

As a matter of practice, it seems advisable, when circumstances permit, that the rate of the chronometer should not depend on observations made at an interval of *less than five or more than ten* days. Seven days will be found a convenient average interval, and in the case of eight-day chronometers, moreover, it is nearly the period affected by the whole length of the chain. With the above limitations, it may be laid down as a maxim, that chronometers cannot be rated too often when time and opportunity permit. The error and rates of the chronometers should, if possible, be obtained by observing equal altitudes of the sun; failing this, by forenoon or afternoon sights, taking care that if the observations on the first day are made in the forenoon, those on the second day should, if circumstances permit, be also made in the forenoon, and *vice versa*.

Captain Lecky, in "Wrinkles" (p. 384), recommends to observe stars east and west of the meridian within a few minutes of each other as the best means of rating chronometers. Of course the conveniences of landing at night have to be considered, but if that can be overcome, there are many advantages in using the stars for this purpose.

"A couple of stars on or near the prime vertical, east and west, can always be found at some hour of the night, let the latitude be what it may. When selecting stars, choose those that have about the same altitude," to neutralize errors. Take care the marked side of the roof of the artificial horizon is always towards the observer.

Advantage should be taken of favourable opportunities of landing at places whose longitudes are well determined to obtain good observations of time, because the difference of longitude between the places will at once discover any considerable change in the rate, afford a new error, and be the means of obtaining that important factor: the *sea rate* of the chronometer!

Captain Wharton remarks, "This method is especially useful for navigational purposes. Suppose a ship to leave Portsmouth and to call at Gibraltar for a few hours only, error can be obtained, and by

¹ See also "The Ship's Chronometer," by H. D. Gardner, in No. 152 of the *Journal*.—Ed.

means of the known difference of longitude a sea rate deduced, which will give a better landfall for Malta than the harbour rates at Portsmouth.¹

Barometer and Thermometer.—These are two tools that would not have been mentioned had I not felt sure they would have been asked about in discussion. They are very useful to the sailor who knows how to use them, but most difficult subjects to talk or write upon. Robert Scott, who may be looked upon as a reliable authority, writes thus upon them :—

"*The Chief Instruments* used for obtaining indications of probable changes in weather are the barometer and the thermometer. Of these the barometer is the more important, and it is, therefore, frequently called a 'weather glass.'

"*The Barometer* is a familiar instrument, but few understand all that it tells us. The general opinion is that when the mercury rises in the tube there will be less wind or rain; when it falls, that there will be more wind or rain; and that when it remains steadily high, a period of fine dry weather is probable; while when it remains low, the weather will continue wet and unsettled.

"These interpretations are usually correct, but sometimes wrong.

"It is not to the mere height of the mercury in a barometer on a particular day that we are to look in order to judge of the weather, but to the fact of its having risen or fallen, or remained steady, since the day before or the last time it was set, and even this alone will not supply conclusive evidence.

"Used without discretion, the barometer is almost as likely to mislead the person consulting it as to guide him aright. The barometer has but two motions, rising and falling, by which to indicate all changes of weather; and any conclusions drawn from its movements require to be checked by observations of temperature, moisture of the air, the present and previous direction and force of wind, and the state of the sky, before a correct opinion can be formed as to what may be expected.

"A sudden rise of the barometer after it has been steady for some time, is very nearly as bad a sign as a sudden fall, because it shows that the atmosphere is in a disturbed state. With a rapid rise of the barometer in disturbed weather, severe squalls are common, though the weather generally improves quickly."²

At sea it must never be forgotten that in practice the ship and the wind are always both moving; not only has the motion of the cyclones and anti-cyclones in which air travels to be considered, but the course and speed of the ship have also to be taken into account.

From the above it will be seen that the barometer is a mysterious tool, that must be closely watched and studied for years with thermometer, clouds, and other surroundings; its movements are never to be neglected. In tropical regions, during the hurricane seasons, they may be of untold importance. Questions as to the weather at sea during an ordinary passage are perhaps best answered by a look

¹ "*Hydrographical Surveying*," p. 233.

² "*Fishery Barometer Manual*," by Robert H. Scott, M.A., F.R.S.

at the barometer and a shake of the head, à la Lord Burleigh. From the barometer and the sky the sailor generally learns more than he cares to tell.

The *Admiralty Wind and Current Charts* may be termed a great collection of facts, as every line upon them is drawn from some ships' actual experience. No theories were allowed to be inserted. There is every probability that the sailor will find the wind blowing, and the water running, as it is shown on the sheets, but let him never forget the harmonious discord of Nature, nor the divine element of chance. To play the game of making a good voyage, I should advise him to study and trust to the wind and current charts, which are attempts to carry out the work so well begun by Maury of the United States, and Fitzroy of our own Navy, and to give the sailor in all parts of the world a good general idea of the ocean winds at the different times of the year; the tracks and seasons of the tropical storms; the winds he may experience on nearing the coasts; the times of the rainy seasons; localities in which ice may be fallen in with; and, lastly, the direction and force of the stream and drift currents of the ocean. These charts place before the sailor who is new to the waters he may be sailing on, the experience afforded by many hundred cases, enabling him to form a correct judgment as to the winds and currents that may be expected.

Telescope and Binocular are important tools to the sailor. They should not have too high a magnifying power; good illuminating power, a wide field of view, and absence of a fringe of colour are the advantages sought. Binoculars should fit the eyes, some men's eyes being farther apart than others.

Tide Tables.—In addition to the above tools, certain books are required containing necessary sea facts as are to be found in the *Admiralty Tide Tables* and in the "*Nautical Almanac*."

There are few points of a sailor's education which require more attention than the study of that important movement of the waters, known as tides. Although his numerous duties will not permit of an attempt at an investigation of the bewildering theories that surround the subject, still he may acquire the requisite knowledge to enable him to discover not only the rise and fall of the tides, but the *direction and velocity of the tidal streams*, with sufficient accuracy for most practical purposes; the knowledge of the rise and fall of 1 foot, or of a set of $\frac{1}{2}$ a knot per hour being often of invaluable service in difficulties.

This study is attended with impediments. The length of ebb and flow are in most places unequal: their length as well as the times of high and low water are, to a certain extent, dependent on the weather: with a strong breeze blowing, neither time, nor height, nor run of tidal stream can be altogether depended upon: therefore, whenever a coast is approached from the open ocean, the *tidal stream* near the shores should be carefully considered. The time of the change of current only coincides with time of high or low water when close in shore.

The *Admiralty Charts*, *Tide Tables*, and *Sailing Directions*, give

considerable information upon this point, and on entering a new chart a sailor's early attention should be given to the tidal arrows, or to any special notes that may be made upon it. He should also remember that the soundings on Admiralty charts are all given for the *mean low water spring tides*.

The Diurnal Inequality is a feature in tidal phenomena, which being particularly small in British waters, has not received the attention it merits from the English sailor, for in the Indian seas, and indeed in most other parts of the globe, this diurnal inequality is a regular change, considerable in amount, and almost universal in prevalence. This change depends principally upon the moon being north or south of the equator; its maximum is consequent on, but not necessarily simultaneous with, the moon's greatest declination, and the period of its vanishing corresponds in like manner with the time of the moon passing the equator.

In consequence of the diurnal inequality, it sometimes happens that the day tides are higher than the night tides, or the reverse, for many weeks together. And hence it has sometimes been stated at such places, that the day tides are always the highest, or the reverse. But this is not the rule. The rule of the diurnal inequality depends on the declination of the moon and sun. If the day tides are the highest at one time of the year, they are the lowest at another.

The diurnal inequality sometimes affects the time of high water as much as 2 hours, that of low water about 40 minutes; at the same time a variation of 12 inches may be observed in the height of high water, and of 36 inches in that of low water. Such effects, "impediments," are far too great to be neglected, either in the prediction of tides or the reduction of soundings.¹

The Rule of the Road should be so thoroughly mastered that there should be no hesitation in the action to be taken in meeting or passing vessels, by night or day, whether under steam or sail. The sailor should be as familiar with these laws as he is with the points of his compass, so as to enable him to move his ship as instinctively as he moves his own body. Helmsmen should be often tried to ascertain that they are able to carry out correctly and quickly the important orders of "Port" and "Starboard." The state of the bow lights as well as that of the masthead lights should be the constant care, not only of the Officer of the deck, but also of the look-out man. The steam-whistle, or fog-horn of a sailing vessel, should always be known to be in a state of efficiency in case of the vessel encountering the sailor's worst enemy, a fog, during which time his vigilance should be increased, and arrangements made for rapid and instant action on meeting or passing another vessel. Speed must be considerably reduced during a fog, and every preparation made to prevent loss of life in one of the most serious difficulties that has to be overcome at sea.

Admiralty Pilots or the sailing directions of the coasts to which the

¹ See *Tide Tables for the Indian Ports*, by Captain A. W. Baird, R.E., and Mr. E. Roberts, F.R.A.S., published yearly by the authority of the Secretary of State for India.

ship may be bound, is another necessity. These books are compiled with great care from whatever may be already written upon the subject, corrected from any new charts that may have been constructed, from remarks of surveyors, English and foreign, and from the remark books of the Officers of H.M. ships. The labour of compiling these works is naturally of a dry and uninteresting nature. Written by sailors for the use of sailors, all fine writing, glowing descriptions, and roundabout phrases are avoided, and nothing but hard salt facts as practical as the pilots for whom this species of literature are intended, is allowed to be written. With painstaking patience, the compilers have not only to do their best to attain infallibility, but also to write the directions in so terse and lucid a manner, that while common-place ability cannot fail to comprehend them, cunning intelligence is unable to read them in two ways, men having been known, with the assistance of a lawyer, to try and use book and chart only *after* their vessel has been lost, with the hope of finding some flaw therein that might be used in the defence. The phrase that "easy reading is hard writing," describes forcibly the onerous task of compiling the Admiralty Pilots.

Raper's Practice of Navigation and Nautical Tables, a book written by a sailor for the use of sailors at sea, has lately been revised with great care. The chapter on the Mariner's Compass has been rewritten, and considering the great increase of speed attained by modern steamships, the traverse table has been enlarged from 300 to 600 miles of distance. A table of the navigable mercatorial distances between the principal ports and points of the world has also been added. Raper's Practice of Navigation is the best practical work upon navigation at sea, in proof of which assertion I will read the following extract from the preface to his first edition:—

"Those who have been brought up to the sea, and who have experienced the distaste for long calculations which that kind of life inspires, will not hesitate to admit that the only means of inducing seamen generally to profit by the numerous occasions which offer themselves for finding the place of the ship is *extreme brevity of solution*. It is not, however, merely as a concession to indolence that rules should be made as easy and simple as possible; the nature of a sea life demands that every exertion should be made to abridge computation, which has often to be conducted in circumstances of danger, anxiety, or fatigue, and so to separate the several points, that the seaman may be referred directly to what concerns his case, to the exclusion of all other matter. These considerations have been carefully kept in view in the rules, in the examples, and in the form and order of the tables."

This idea Raper piously carried out, and his short rules aid the prompt decision upon which the safety and success of a ship at sea so often depend.

"*Wrinkles*," by S. T. S. Lecky, Master Mariner, Commander R.N.R., is another publication I strongly recommend to all sailors. The great charm of the book is that the compiler does not ascend to what some term the scientific, and it is written in language thoroughly familiar

to the nautical ear. In a pleasing and attractive manner, Captain Lecky calls attention to the important elementary principles of navigation, and especially deals with the handicraft or mechanical part. The book is a friendly offer of help from one sailor to another. The subjects I have so lightly touched upon this afternoon will be found fully and graphically treated upon in "Wrinkles."

The Sailor's Pocket-Book, now in the eighteenth year of its age with a vigorous sale, is well known to most sailors. Full of useful facts relating to the handiwork of navigation, it is part of my duty to call attention to a small volume no sailor should be without.

In concluding this part of the paper, I must again apologize to sailors for bringing them so far to hear so little. Still I trust I may be forgiven on the plea that, unless the important simplicities spoken of are well known, the tools exhibited cleverly handled, and above all, if there have not been good considerations had to those *impediments* of John Davis, the navigator, caused by the instability of water; the serious and distressing disasters fresh in our memories will assuredly re-occur.

The truly scientific man will always command my thanks and my admiration; all I ask is, that in the position he holds as a probable educator, he will reverence and teach, or cause to be taught, the handicraft of navigation at sea.

Lastly, I assert that pilotage or navigation must not be slighted on account of its apparent simplicity. Gunner, Engineer, and First Lieutenant are all important aids to the Captain; but second to none among them stands—and shall stand while the sea remaineth—the Pilot! Render then unto Cæsar. Let the office be so respected that the best among the sons of the sea shall seek to hold the proud position of Pilot of Her Majesty's ships and vessels of war.

MR. E. W. BULLER: Mr. Chairman, I ask leave to make a few remarks upon the paper to which we have just listened. To an audience such as this, closely connected with the subject, the lecture cannot fail to have been deeply interesting. No one knows better than my friend the lecturer that to me it has been a study of the deepest interest almost for my whole life, although I have never been professionally connected with the sea. I should have expected, from the many discussions I have had with Captain Hull upon this subject, which is of such interest to both of us, that I should not have felt, as I have to-day, that there is so much difference between us, with regard especially to the opening part of the lecture. My belief, as I have stated on previous occasions, is that there is in the scientific art of navigation a deep line of distinction drawn between the science and the art which you do not find in any other practical science. Raper himself has taken that line. He said, "Practice first and then theory afterwards," and in that very preface from which you have heard notable words read he goes on to say, "I will follow this up by a work on the theory of navigation." That we have never had; and if we had seen what he had to say upon theory as well as what he had to say upon practice, his treatise on navigation would have been, in my humble opinion, a much more complete work on the subject. I would also refer to another point respecting this line of demarcation. Captain Hull has gone the length of saying things which I would never have dreamt of, and in his opening remarks he spoke as if he would divide mankind into two boxes, and put all men who work with their hands in one box and all men who work with their heads into another box; and then he makes a most sweeping assertion, he says, "We all do it, we all say the head box is better than the hand box." Now I respectfully deny that altogether. If you deny

what is said by a naval man, a man who knows the subject and is well qualified to deal with it, it is only respectful to give to some extent the reasons on which you base that denial. I deny that you can get over the work either with the hand alone or with the head alone. The hand has been called the instrument of instruments: so it is; it is the machine, as it were, in which we hold the artificial machines which we use. And what are these instruments? They are only the means by which the human mind endeavours to correct the imperfection of the senses, and to extend its own dominion and power over the phenomena of nature with which we have to deal. If our eyes were good enough we should want no other instruments to assist them; if our hands were exact enough we should want no other instruments. We find that other helps are required, and the human mind supplements the deficiency in the human organs just in the same way as we also reason by the artificial use of language. All these are tools contrived by the mind, and these tools contain, as it were, a portion of the human mind; they contain, to use the word of Lord Bacon, "doses" of the mind, and it is according to the "doses" or quantity of the human intellect which is embodied in these tools that they take their rank. If it is proposed to catalogue the various tools used in certain handicrafts, I agree it is an admirable way of looking at a handicraft, because these tools form its record. But one tool is not the same as another tool; it differs from it for this reason, that one contains a greater dose of intellect, a greater depth of mind. Take, for instance, one of the simplest tools now exhibited here. Take the lead line; a man may be able to use that perfectly, he can read its marks and depths in the dark, and give an excellent result. But let him take some other instrument: take the sextant, for example, and ask him to use that. He cannot do it. He uses grades of tools which he is able to use, and if you put him to a higher grade of tools, which requires a higher dose of mind and intellect, you go beyond him. How can you possibly distinguish between men who work with the hand and with the head? They ought to be worked together; that is the way that all the best work is done. The men who have made the greatest mark in engineering—the Stephenson and the Nasmyths and other pioneers of that science—have been men who knew their business from the workshop upwards. So you will always find that the union of hand and head is most conspicuous in those men who first take the lead in any branch of science. Take Sir Isaac Newton, take the elder Herschel, what did those men do? They constructed their own telescopes, cast and finished their own specula, and ground their own lenses. Why did they do it? Because they were themselves superior in skill to any obtainable workman. We have had a most interesting collection of instruments laid before us, but I think the most important instrument of all has been omitted. The most important instrument, in my opinion, for navigation is the one which in such a remarkable degree brings all the greatest efforts of mathematicians down to the grasp of comparatively ignorant men. What is that? It is the triumph of navigation, it is the "Nautical Almanac." That is the finest tool of all, and I think it ought to be mentioned. I feel that there is more to be said than is suitable to the time available for purposes of discussion. I hope that on some future occasion I may have an opportunity of again referring to this matter before this Institution.

Professor LAUGHTON: I made a point of attending this afternoon at some personal inconvenience, because, having had an opportunity of reading the paper, it occurred to me that it might possibly be said that Captain Hull was rather down on Naval Instructors, and I wished to have an opportunity of saying that I for one, a Naval Instructor of some standing, did not take that view of his remarks; that I thought the criticism was, to a certain extent, a fair one—not on Naval Instructors, but on the Admiralty who appoint Naval Instructors. I may say that on first going to sea I felt very much adrift. I was called on to instruct Midshipmen who had been some three or four years at sea, and who knew a great deal more about the practice of navigation than I did. I had not even any knowledge of how to take an altitude to the sea horizon, and I had to learn it from the very Midshipmen whom I was there to instruct. Though Captain Hull's idea, that the Naval Instructor should have a year's experience at sea before he is called on to teach, is not a practical one, there is much in it that captivates the fancy. But our Government has a way of picking men out for appointments rather on account of their ignorance of the

conditions of their service than for any special capacity; and that is the rule in all grades, from the Naval Instructor to, I think I might almost say, the First Lord of the Admiralty. With a great deal that Captain Hull has said of the mechanical part of navigation I entirely agree. We know, from former utterances, that Captain Hull is a great admirer of the philosophy of the late Mr. Squeers, who, having heard one of his boys spell "oss," would say, "Now you know how to spell it go and rub him down or I will rub you down." The practical part of Mr. Squeers's teaching may have been very good, but, at the same time, we cannot help feeling that his theoretical teaching was capable of improvement. And so I think, in laying all stress on the mechanical part of the work, Captain Hull rather overlooks the necessity for the theoretical. I think Mr. Buller laid his finger on the blot, if I may say so, of Raper's admirable book as a practical book on navigation. Raper's is by far the best which has been published; but it labours under the disadvantage of not explaining the principle on which it works, and men who like to understand the principles, or who have to pass an examination in them, have neglected the book, so that it has never been a favourite in the Service. There are, of course, other reasons for its never having been adopted as a text-book, but that is one, and is in itself sufficient. Raper intended to write a theoretical volume, but I believe he died before he could do so.

Lieutenant G. T. TEMPLE, R.N.: I am afraid that I cannot contribute anything of value to the discussion on the thoroughly useful and practical paper which we have had this afternoon, but there are one or two points I should like to touch upon. After listening to the lecturer's remarks about "Submarine Sentries" and "sounding with piano wire," I think some of us may need a reminder that at some time subsequent to the "Stone age" there was a period which we may term the "days of oak and hemp," and that period was the cradle of our modern seafaring. In those days sailors sometimes invented, and frequently had to make, their own nautical instruments, and they therefore thoroughly understood the tools they had to work with. We, of course, gain incalculably by the perfection of modern appliances, but they must, to some extent, tend to make men less self-reliant, alert, and resourceful. I think, therefore, that the lecturer has done wisely and well in insisting so strongly as he does upon the absolute necessity of unceasing attention to important simplicities and constant practice in fair weather. Those whom John Davis would have called the "unlearned" are fully alive to this. For instance, not very long ago it was noticed one fine day that the numerous beacons and buoys with which the sea is speckled at the mouth of the Thames were a continual source of apparently artistic study to the pilot of an outward-bound steamer, and, as everything seemed clear and easy, he was asked the reason; "I never omit, sir," he answered, "taking as many bearings as I can on a fine morning like this, and they comes in handy when I chance to pop on one of them buoys in thick weather or night times." That man had a typical pilot's head. It was not only a complete tide table, but it was full of bearings, lights, and buoys from Gravesend to Plymouth Sound. With regard to the lead, it is perhaps not too much to say that the North Sea fishermen, who form a large and very important section of our seafaring community, actually live by it. At all events they could not live without it. These men know little or next door to nothing of navigation, but they feel their way about by the lead as if they had an extra sense. Wonderful stories are told of their marvellous skill in this respect. On one occasion an attempt was made to puzzle a famous fisherman and pilot named Kroon. When the vessel he was serving in was in the North Sea, the men in sounding brought up some of the ground, and kept it secretly. Some days afterwards, when in the English Channel, they brought some of the Doggerbank soundings to Kroon, and asked them to tell by it where they were. Kroon, who was lying in the semi-darkness of his bunk at the time, looked at it carefully, smelt it, and then said very quietly—

"Oh fine ground of the Dogger sand,
How come you here in the Channel to land?"

I do not agree with the lecturer's suggestion, that questions as to the weather are best answered by a look at the barometer and a shake of the head. I do not think

that is worthy of his reputation as a sea-father, because I have heard of an old yacht skipper who could do better. He used to gravely assure nervous passengers that during forty years' experience at sea, man and boy, he had always found some sort of weather at that time of year. I am afraid that, like some other professional men, pilots, as they advance in years, sometimes become confirmed pessimists with regard to the weather. There was a well-known Channel pilot who, after he was sixty, never answered a Captain's greeting of "Well, pilot, what d'ye think of the weather?" in any other form of words than this: "Well, Captain! I consider it looks very inferior, very inferior indeed." One word only about sailing directions. Last year a 15th century MS., which was found in the Lansdown library at the British Museum, was printed for the first time by the Hakluyt Society, and included in their annual volume. It is a genuine specimen of the "Rutters of the Sea," or sailing directions, with which sailors had to be content in the days of John and Sebastian Cabot, and, as I had to review the book, I thought it would be interesting to compare now and then. I found that, at the present time, the ground covered by this tract of twenty pages, which includes sailing directions not only for the circumnavigation of England and Ireland, but also for a voyage to the Straits of Gibraltar, occupies no less than nine volumes of the Admiralty "Pilots," and bearing in mind the laborious care, and the wealth of material, which each of those volumes represents, I think that our Chairman and the lecturer, both of whom have so largely helped to advance nautical science to the position it holds at present, have no reason to be dissatisfied with the comparison.

Staff-Captain TIZARD: With regard to what has been said as to the theory of navigation taught at sea, my own experience is that the theory of navigation is best taught on shore by mathematicians, and that the instruments used for navigation are best learned to be handled on shore, so that when the men or the boys go to sea they may not have to learn to use the instrument as well as to keep their sea legs. A great many of the instruments we have to use that are necessary for sea have also to be used on shore. An "artificial horizon," for instance, cannot be used at sea, and some of the other instruments that Captain Hull remarked upon. With respect to Birt's nipper and bag, that was a very good instrument on the whole. I used it myself a great many years, but it is only applicable to the old-fashioned deep-sea line which was made of cable-laid rope. Now, with hawser-laid rope, I find, by experience, that it will not grip, so that it is practically of no use; it must be thrown on one side, unless we use the cable-laid rope again, which is not trustworthy for soundings. It is not so strong, and it stretches very much more than the ordinary hemp line does. With respect to North Sea fishermen, I have had a good deal of experience of their knowledge of the depths in the North Sea, but my experience is very different from Lieutenant Temple's. I never yet found a fisherman that knew where he was within 20 miles; they go by a rule of thumb entirely. When I have asked them where they were, or where a bank was, when I have been surveying, I have found that they had no more knowledge of where it was than the man in the moon. They have a vague idea that they are in the North Sea, but as to where they are, within 20 miles, they do not know.

Admiral Sir HOUSTON STEWART: I should be very sorry to differ in any respect from such an experienced navigator and seaman as Captain Hull, and it is quite possible I do not differ from him, for I hear imperfectly, and I do not know that I gathered correctly what he meant to convey with reference to Naval Instructors; but my experience of Naval Instructors is quite the opposite of what I understood from Captain Hull's paper. I could name Naval Instructors, with whom I have had personal experience at sea, who were, under all circumstances, good practical navigators at sea; and, excellent navigators as the navigating Officers in the ship were, these Naval Instructors were better acquainted with the scientific theory of navigation, and were the means of imparting valuable instruction to many of our best naval Officers. Looking back to the past, I believe that many of my brother Officers (perhaps gone from the scene now), who were excellent navigating and scientific Officers themselves, have been associated in their career with Naval Instructors who had been of the greatest benefit in instructing in navigation the younger Officers of their ships. With reference to pilots, I would observe how completely the professional pilots for the North Sea and Baltic failed in our ships

the first year of the Russian War of 1854. They were obtained with great trouble and expense. The first year, when our ships went to the Baltic, they proved so useless that the Masters took charge of the ships as pilots themselves. These Officers made themselves acquainted with places where they had never been before, and the second year they requested that there might be no pilots sent with the ships. Having myself served in the fleet, and having had a pilot on board who was of no use, and a Master who was perfectly master of the subject, I can only say that pilots are not always to be depended upon. My only object in venturing to get up just now was to say a word in favour of those valuable Officers of whom I have had experience—our Naval Instructors.

Commander HULL, in reply: Ladies and gentlemen, with regard to Mr. Buller's remarks, my wish was to bring the head and the hand a little together, to remove pride from one and prejudice from the other. I am very much obliged to Mr. Buller also for mentioning the "Nautical Almanac." There was one on the table, but I must have omitted calling attention to it in the lecture. I shall take care when this is printed that the "Nautical Almanac" is inserted. I thank Mr. Buller for calling my attention to the omission. I was obliged to our friend Professor Laughton for his remarks, and I am sure he has expressed my feeling. I have a great admiration, as great as Sir Houston Stewart, for the Naval Instructor, and I am glad to hear from him that he found Naval Instructors also good navigators. I should like to ask him, Were those Naval Instructors tried in bad weather? Were they able to make the land in thick weather, and do the work of good common pilotage?

Admiral Sir HOUSTON STEWART: I could tell you of some that certainly were, some that had been the greater part of their lives at sea. I will not mention names, but, however, the Naval Instructor on the last ship I had had been Naval Instructor to some five or six line-of-battle ships.

Commander HULL: That is one of the points of my paper, pilotage in bad weather.

Sir HOUSTON STEWART: They always appeared at the dinner table at sea, at any rate.

Commander HULL: One of the points of the paper was to call attention to what old John Davis has named "impediments." I think there is not, perhaps, respect enough paid to navigation in bad weather, and I wanted that to be a little more considered. That is why I suggested in a playful way that all people appointed by the Admiralty to teach navigation should be presented with sea, *i.e.*, waterproof, garments, to remind them that navigation is most useful in bad weather. From experiences in the Oriental S.N. Co's. steam yachts, I know something of the nervous passengers that my friend Lieutenant Temple has spoken about, and I generally found the best plan was to say as little as possible, or to use your knowledge of the weather in a light and pleasant manner. There was one small discovery made with regard to weather that ought to be brought to the notice of Mr. Robert Scott. It is that good weather depends very much on good temper. A good-tempered ship will make a fair-weather passage. Lately in one of these yachts a little event had ruffled the tempers of some of our community between Gibraltar and Malta, and I assure you when we turned the corner of Cape St. Vincent, between that and Cape Finisterre, we had about a day and a half of nasty weather, and I could only consider that this was caused by the little tempers that got out of the ship into the atmosphere. I think it is a subject for the Royal Meteorological Society to consider! With regard to Birt's nipper, some improvement might be made to the nip to make it bite the rope. I am very much obliged to Captain Tizard for his experience in the matter. Then with regard to fishermen abroad, in my experience of surveying (I have not had anything to do with English fishermen), I have always found them particularly artful. They will not tell you at first where rocks are; they do not want you to know their ground. It may be that in their simplicity they do not tell you all they know, because they do not quite understand what you are after; others think it may lead to poaching on certain small localities known only to and useful to themselves. I am just saying a good word for these fellows, from whom I have obtained much information by humouring and getting on their soft side. Although Sir Houston Stewart found fault with local pilots, and pilots

that were taken out to the Baltic, still all the Admiral has told us proves the goodness of the pilots in the main, *i.e.*, of the then Masters of men-of-war, because (I called your attention to the title in the opening of the paper) the Master is to all intents the resident pilot of the ship, so that when one member of the class failed and became an impediment another pilot came to the front. I have to thank you very much for the kind attention you have given to my paper. The Council asked me to treat also on "nautical surveying," but time did not permit. In writing or speaking on practical nautical surveying, I can add little to the paper read in this hall nineteen years ago, that for some time held a place among the Greenwich text-books. In this paper I had the assistance of my friend, I should say *our* friend, the late Admiral Ryder, who worked at the lecture as if it had been his own, and to whom much of its success is due. Ten years afterwards, in 1882, Captain Wharton's "Hydrographical Surveying" appeared, and naturally took the place of my small paper. Still, as the Chairman has kindly thought fit to recommend "Practical Nautical Surveying" in his "Notes bearing on the Navigation of H.M. ships," and the Council of this Institution have asked for more, I can only suggest a republication in your Journal, which I promise to carefully revise.

The CHAIRMAN (Captain Wharton): Gentlemen, the lecturer has brought before us this afternoon a subject that he reminded us is very old, but it is one that I think it is well this Institution should consider from time to time, even though there may not be very much new to be said about it. I think, however, Captain Hull has managed to put it before us in rather a new way. The object of the Navy, of course, is war, and I think, in the overpowering interest of perfecting ourselves in the destruction of our enemies, we sometimes forget that there naturally comes to the forefront, what is generally considered, the necessity for preserving our own lives. A mistake about guns or even about machinery, or some of the other branches of a naval Officer's trade, does not have a very great effect, except in war-time. But the navigator is, so to speak, always at war, that is to say, a small error of his may at any time, whether in peace or war, cause destruction not only of property but of a vast number of lives. I understand the lecturer's object was to draw attention to the fact that, although you may learn theoretically a thing perfectly, what you want above all things in navigation is practice and experience at sea. To my mind the great point to aim at is a right judgment, and that judgment is only to be obtained by long practice and experience. There are times when it is permissible to run risks; there are times when it is proper to be cautious, and a mistake in discriminating between these two has led us often to disaster. Most of the shipwrecks and groundings with the details of which I am acquainted, show very clearly that risks have been run from want of appreciation of understanding how far knowledge is possessed by the ship at the time the particular action has taken place. I am sure we shall agree with Captain Hull that constant practice with these common instruments that we see before us is not only necessary, but it is to those who take an interest in it, an engrossing study; that it requires of them certainly as much study as any other branch of Her Majesty's Navy; and if ever the day should come that there are not a sufficient number of Officers to take an earnest interest and devote their lives to the practice of navigation, it will be a very evil day for the Navy of England. There was one little thing that Professor Laughton said that I must express my dissent from, and that is that Raper is not a favourite at sea. My experience is entirely the contrary. Every navigator who has had much experience invariably goes to Raper. He may not originally have been taught it, for the reason that Raper unfortunately died before he was able to complete or to commence the work that would have completed his book, and therefore it is not possible to make Raper a text-book, because the theory of it is not there. For that reason it has not been used as a text-book, but that it is not a favourite at sea I cannot agree with Professor Laughton.

Professor LAUGHTON: I did not say at sea, I said in the Service.

The CHAIRMAN: I also mean in the Service.

Professor LAUGHTON: I was speaking of navigating Officers. They, no doubt, use it; but it has never been recognized by the College, nor by men working up for examination.

The CHAIRMAN: I mean a navigator who is really experienced will eventually

find himself going into the arms of Raper as his best friend. There is a little point I should like to bring to the notice of the meeting, a diagram of a very mathematical character indeed, that has been recently drawn by the second mate of a merchant vessel in Australia. That little diagram, Captain Weir's azimuth diagram, will give you, with the very minimum of trouble and without any possibility of mistake, I think I may say all the information that you can get out of Burdwood's and Davis's Tables, and a great deal more, because it will give you the true bearing of a celestial object for all altitudes and all declinations. Sir William Thomson said he was perfectly astounded and staggered to think that a seaman has produced what all the mathematicians in the world who have tried have failed in doing. It is founded on strictly mathematical principles, but, strangely enough, the author himself knew very little mathematics indeed. I should recommend this little diagram to anybody who wishes to spend 1s. 6d. when other books cost you 14s. 6d. It is a most marvellously constructed diagram. I am sure the meeting will join with me in thanking Captain Hull for having given us the opportunity of discussing this question.

NOTICES OF BOOKS.

Naval Warfare, its Ruling Principles and Practice. Historically treated. By Rear-Admiral P. H. COLOMB. London: Allen, 1891. Pp. 448. Size 10 $\frac{1}{4}$ " x 6 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ ". Weight under 3 lbs. 12 ozs. Price 21s.

Admiral Colomb is to be heartily congratulated on the result of the thought, labour, and time which must have been expended in the preparation of this great work. Admiral Colomb's book will occupy in naval literature the same position which Sir E. Hamley's "Operations of War" does in military literature. Each is the standard English work on the principles of the particular kind of warfare with which it deals. The Admiral is afloat, the General ashore, each on his own native element. But the Admiral has, as a writer, an obvious advantage over his land *confrère*. The study of the Napoleonic wars is very profitable, but to the dwellers in these islands the interest in them is somewhat remote, and the influence of the issue of those great struggles on this country was too indirect to come home at once to ordinary Englishmen who read the "Operations of War." This classic work is too exclusively professional in its shape and contents to be read much outside military circles. *Naval warfare* is essentially *the warfare* to interest Englishmen, because, however bravely may our soldiers have fought in the interests of the Empire on land, the struggles have been carried out at a distance from our own shores, and that on their issue depended sometimes the safety of those shores has not been always recognized. In the very second page of the Admiral's book comes, however, a reminder that in naval warfare every Englishman has an unpleasantly direct interest, for the author brings vividly before us the old practice, never, we believe, destined to become obsolete, which he has christened "cross ravaging," sudden descents of the enemy on our coasts, carrying sword and fire all around. The veriest Cockney that drives a quill in some merchant's counting-house in the City knows that for him the protection of commerce means not so much butter for his bread as bread for butter. In all this, naval superiority is the prominent matter. Protection of commerce means, as the Admiral clearly shows, naval superiority at sea. First thrash the enemy's army in the field is the military axiom; ditto, shows the author, should be the axiom for the Navy. "The Differentiation of Naval Force" is a terrible heading for a chapter, one of the most interesting and instructive of the book, giving the process of evolution by which a mob of fighting floating machines became classified into various kinds, each adapted to some need of naval warfare, line-of-battle ships, frigates, and cruisers. Admiral Colomb devotes about half his book to attacks on territory from the sea. This is admirably written. We hope that the Admiral will follow up the publication of "Naval Warfare" by the fulfilment of the half promise given of a further enquiry into the secondary operations of naval warfare.

War. By Colonel F. MAURICE, R.A. London: Macmillan, 1891. Pp. 155. Size 9" x 6" x $\frac{3}{4}$ ". Weight under 1 $\frac{1}{4}$ lbs. Price 5s.

This volume contains, besides the article "War," originally published in the latest edition of the "Encyclopædia Britannica," an essay on military literature, a selected list of books on military subjects, including histories of campaigns, with a short, but by no means unimportant, preface, which touches on the warfare of the future. Of course, the reprinted article overshadows the rest in importance, but it is well to call attention to them, so that they may not be regarded as mere appendices. The article by itself takes its place rightfully among military standard

literature, and every page is worth close perusal and study. It is deep enough for the thinkers and the philosophic mind, and simple enough for those who do not care to take the trouble to think too much for themselves. The essay on military literature is full of valuable hints and suggestions, whilst the list of books meets a pressing need for individuals and libraries alike.

The Naval Annual. By Lord BRASSEY, K.C.B. 1891. Fifth year of publication. Portsmouth: Griffin, 1891. Pp. 484. Size 10" x 6 $\frac{1}{4}$ " x 1 $\frac{1}{2}$ ". Weight under 2 lbs. 10 ozs. Price 10s. 6d.

This very valuable work has been fully brought up to time, and gives promise of yet increased excellence. Lord Brassey controls Part I, and deals with the year 1890, English and foreign naval manœuvres, 1890; the Board of Admiralty, administrative efficiency, influence of naval power in modern times, training and education, foreign policy, coaling stations, the Naval Defence Act, future policy of war-ship building, description of ships recently constructed, &c., and the influence of sea power on history.

Part II, for which Mr. Barnes is responsible, gives a list of British and foreign armoured and unarmoured ships; while in Part III Captain Orde Browne deals fully with armour and ordnance. Part IV contains statistics, official statements, and papers.

Great Commanders of Modern Times and the Campaign of 1815. By WILLIAM O'CONNOR MORRIS. London: Allen, 1891. Pp. 364. Size 10" x 7" x 1 $\frac{1}{2}$ ". Weight under 3 lbs. Price 21s.

These studies originally appeared as essays in the "Illustrated Naval and Military Magazine." The author is a member of the legal profession, and gives in this volume the views he has formed, after close study of military history, consideration, and weighing of evidence, of Turenne, Marlborough, Frederick the Great, Napoleon, Wellington, and von Moltke. The papers on the campaign of 1815 are, the author states, the least fugitive pieces of any in the volume, and he adds that he has formed his opinions after a careful study of nearly every available authority on the subject, and that he has had the advantage of some special information, not yet given to the public. In two particulars the account he gives of the Battle of Waterloo may, he says, be flatly contradicted or sharply criticized. As years go on, the Waterloo Campaign, under the scalpel of critics, gradually is merging into that class of things which "no fellow can understand."

Life of Sir John Franklin, and the North-West Passage. By Captain A. H. MARKHAM, R.N. London: Philip, 1891. Pp. 324. Size 7 $\frac{1}{2}$ " x 6 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ ". Weight under 1 lb. 10 ozs. Price 4s. 6d.

This is the seventh volume issued of "The World's Great Explorers and Explorations," and is well up to the standard of the series.

Gregg's Cavalry Fight at Gettysburg: a Historical Address.
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These small works were published in Philadelphia in 1884, and have just been kindly presented by the author, Mr. William Brooke Rawle, to the Institution. They contain accounts of the conduct of cavalry which seemed equally able to fight on foot or on horseback, and to use either the sabre or the firearm.

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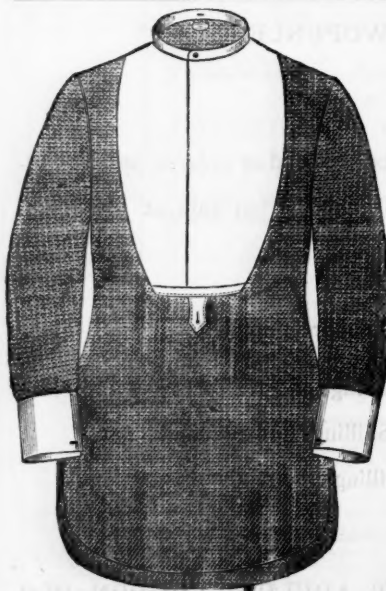
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